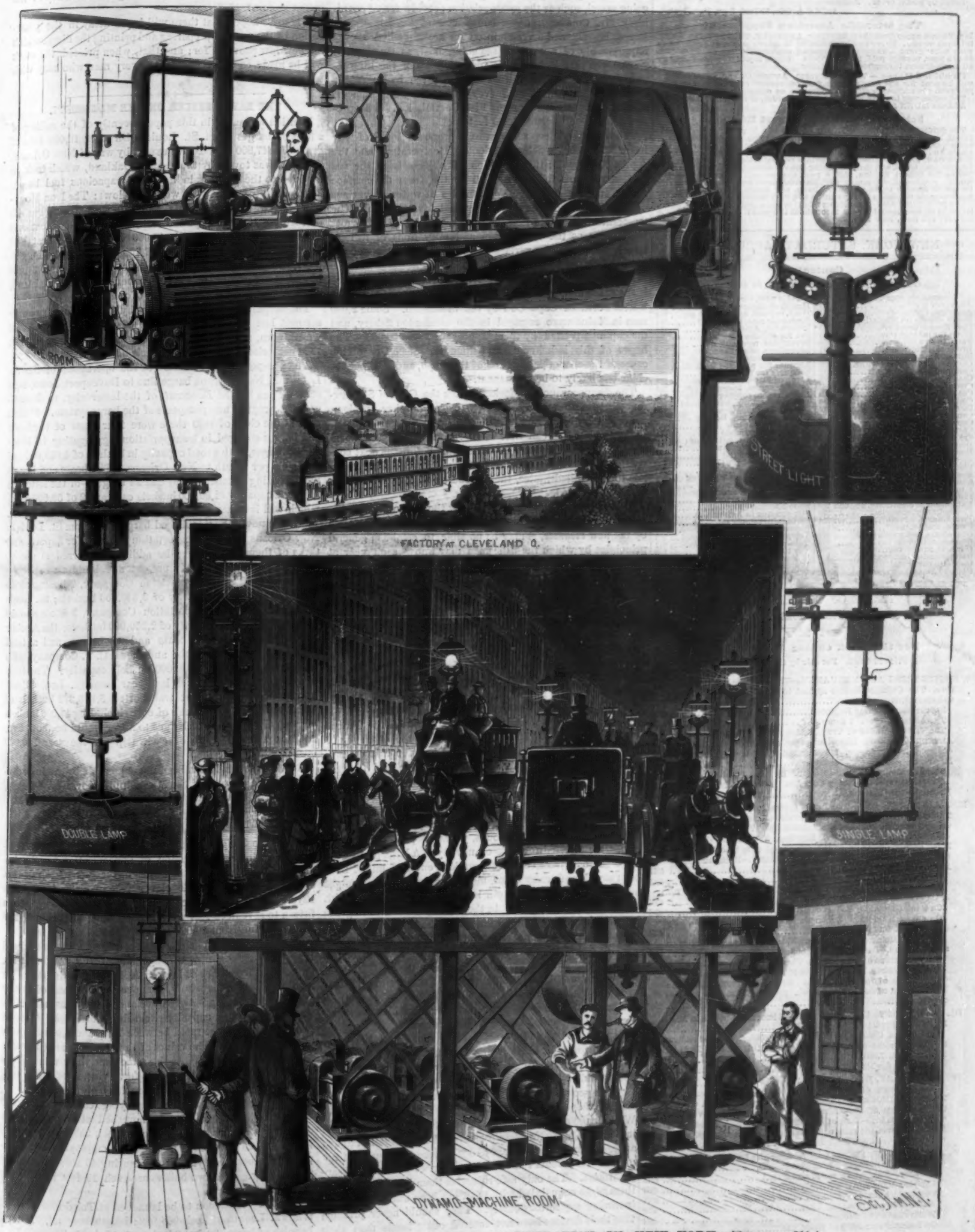
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLIV.—No. 14. [NEW SERIES.] NEW YORK, APRIL 2, 1881. [$3.20 per Annum. [POSTAGE PREPAID.



THE BRUSH ELECTRIC LIGHT STATION.—STREET ILLUMINATION IN NEW YORK.—[See page. 211.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, APRIL 2, 1881.

Contents.

(Illustrated articles are marked with an asterisk.)

Air locomotive, compressed..... 214
American goods..... 217
American industries*..... 211
Barge system on Mississippi..... 208
Beer wagon, Russian*..... 215
Birch for cabinet work..... 213
Bone, to dye (31)..... 218
Brush electric light*..... 207, 211
Butter, American, in Ceylon..... 209
Carbons, experiments with*..... 210
Carbuncle, treatment of..... 212
Cast iron, carbon in (2)..... 218
Circular saw, Reese..... 209
Coal gas, cost of..... 209
Collodion films..... 213
Color organ, the..... 217
Confectioners, about..... 217
Copying pad (17)..... 218
Craft, large, on the lakes..... 208
Crematory, proposed, in B'klyn.. 214
Decisions relating to patents.... 213
Deep sea fisheries, our..... 208
Electrical battery, gigantic..... 215
Electrical dre indicator*..... 210
Electricity, tides of..... 212
Electric light, Brush*..... 207, 211
Enamel for tinware (22)..... 218
Entozoon in the ostrich..... 209
Exhibition of electricity, French 209
Fire indicator, electrical*..... 210
Flue kindler, novel*..... 214
Fishes, scaly-finned*..... 215
Gas, cheap, and public pront..... 217
Geological survey, the..... 212
Glass, to frost (14)..... 218
Glass, toughening, mode of..... 213
Gold and silver statistics..... 216
Gold, to deposit on glass (34)..... 218
Handle new, for soldering irons* 218
Health statistics, comparative... 213
Heat, radiant, experiment on.... 210
Hydraulic ram, improved*..... 214
Industries, American*..... 211
Ink for stencils (12)..... 218
Inventions, mechanical..... 213
Inventions, miscellaneous..... 216
Iron, to protect from rust (3)..... 218
Lacquer for nickeled work (1)... 218
Lacquers for brass..... 209
Lamp of 100,000 candle power.... 210
Leather scraps, to cement (18)... 218
Lithographic copying pad (5)... 218
Manchester, Eng., how lighted .. 217
Mechanical inventions..... 213
Mining exhibition, Denver..... 209
Oil, tallow, and tow..... 216
Oils, purifying, mode of..... 214
Orange blossoms, extract of (19). 218
Outlet for the Northwest..... 215
Paper, to harden (13)..... 218
Paste, bookbinder's (6)..... 218
Patent decisions..... 213
Patents, United States, Index of. 208
Postal money orders..... 217
Researches on magnetic force... 213
River, a, disappearance of..... 213
Shoe blacking (15)..... 218
Silk growing in America..... 217
Springs, to temper (9)..... 218
Stereotyping (8)..... 218
Telephone, etc., improvement in 213
Tele-photography..... 217
Toy torpedoes, dangerous ... 209
Water supply of Cincinnati..... 209
Webster, Daniel, Atley 216
Whirlwind, safety, new*..... 214

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 274.
For the Week ending April 2, 1881.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ENGINEERING AND MECHANICS.—The Outridge Engine. 5 figures. The Outridge Engine applied to a Steam Launch. Plans and elevations..... 4367
Improvements in Gas Engines..... 4367
The Aerial Railway. 1 figure..... 4367
The Various Modes of Transmitting Power to a Distance. By ARTHUR ARCHARD. Important paper read before the Institute of Mechanical Engineers. I. Transmission of power by wire ropes. II. Transmission by compressed air..... 4367
The Invention of the Link Motion. By JOHN ORTTON..... 4368
On Machines for Producing Cold Air. 10 figures. The Lightfoot Machine, with diagrams..... 4369

II. ELECTRICITY, ETC.—The Brush System of Electric Lighting. The construction of the Brush dynamo-electric machine. 6 figures. The construction of the Brush lamps. 7 figures..... 4359
The Brush System of Electric Lighting. By CHARLES F. BRUSH, M.E. Peculiar features of the dynamo-electric machine.—Peculiar features of the lamps.—Results attained.—Recapitulation.—Remarks..... 4362
M. Wiedermann's Electric Paper..... 4364
The Telephonic Systems of Dr. Cornelius Hertz. By COUNT DU MONCEL. 11 figures..... 4364
On Radiophony. By E. MERCADIER..... 4365
On an Acoustic Phenomenon Noticed in a Crookes Tube. By CHARLES R. CROSS..... 4365
Roncalli's Melograph. 2 figures. Melograph arranged for use on a parlor organ.—Details of the mechanism of the melograph..... 4366
The Microscope and the Atomic Theory..... 4366
Physical Society, London.—Notes of meeting of January 22.—The Construction of the Photophone. By Prof. S. THOMPSON.—The Measurement of Small Resistances. By Mr. GLAZEBROOK.—Discussions..... 4366

III. MICROSCOPY AND MEDICINE.—Abnormal Entozoa in Man. By Rev. SAMUEL LOCKWOOD, Ph.D..... 4372
On Chicken Cholera.—Study of the conditions of non-recidivation and of some other characteristics of this disease. By M. L. PASTEUR..... 4372
Hereditary Syphilis..... 4373

IV. GEOGRAPHY, ETC.—Japanese in English Type..... 4370
The Discovery of the Sources of the Niger.—Explorations of Zweifel and Moustier. 4 illustrations.—The expedition crossing the mountains of Ilig Boumba.—Passing the Falled River upon a bridge of lianes.—View of the village of Tantafara and of Pic Koula.—View of the Hills of Tembi-Coundon, the principal source of the Niger..... 4370

V. AGRICULTURE, ETC.—Sheep Farming on a Large Scale.—Methods and results of sheep raising in Australia..... 4373
Manures.—Relative values of manures..... 4373
Applying Manure..... 4374
Wisconsin Farming..... 4374
Waste of Horse Life..... 4374
Whitewood and Cottonwood..... 4374
On Rational Seasoning of Wood, etc..... 4374

OUR DEEP SEA FISHERIES.

Among the important items of the Sundry Civil Appropriation Bill of the late Congress was one granting $103,000 for the construction of a sea-going steamer for the use of the U. S. Fish Commission. The vessel is designed for purposes of deep sea exploration, and will be constructed under the supervision of Professor Baird.

A considerable amount of good work in this direction was done last summer with the little Fish Hawk during an interval of forced inaction in the work of fish hatching, for which she was specially designed. Taking advantage of spells of settled weather the Fish Hawk made three runs to the edge of the Gulf Stream, spending twelve hours on each occasion in deep sea work, but not daring to stay longer because of the unfitness of the little craft to endure rough weather. To do the work properly would require a properly equipped sea-going vessel, such as the appropriation provides for. Accordingly Mr. Copeland, naval constructor of the Lighthouse Board, has planned a vessel in which are embodied all the requirements of a staunch sea-going boat, as small as the service will permit, but able to do any work of the kind required, and at the same time fitted for the hydrographic service of either the Coast Survey or the Navy Department, when no longer needed by the Fish Commission. The proposed vessel will be about 200 feet keel.

The method of deep sea research proposed by Professor Baird will embrace determinations of temperature and the depths of currents; the collection of objects from the sea bottom and from the water at all depths, from the surface down; and the collections of samples of water at various depths for chemical and microscopical investigation. The temperature investigations, he thinks, will be of very great importance, as the distribution and migrations of fish are largely influenced by variations in the temperature of the water inhabited by them.

Among the problems to be solved by these investigations is the cause or occasion of the recent abandonment of the waters north of Cape Cod by the menhaden. Some 2,000 men in Maine were engaged in the menhaden fishery, and the capital invested by them approached $2,000,000. The hopes of this industry depend upon the discovery of the cause of the change in the habit of these fish, and whether the change is likely to be permanent.

The disappearance of mackerel from the Gulf of St. Lawrence is instanced by Professor Baird as another problem, the solution of which requires the use of a sea-going vessel. If the Commission can determine the probability of a continued absence of the fish from the Gulf before the next convention is held to consider the value of the Canadian fisheries to the United States, the impending negotiations will be greatly simplified.

The Commission also hopes that by the thorough scientific study of the habits of our coast fishes, to be made possible by the new steamer, it may be possible to establish general principles by which the fishermen may know each year at what points to meet the incoming schools of mackerel and menhaden, and thus save weeks of fruitless search for them.

INDEX OF UNITED STATES PATENTS.

One of the most conspicuous, at the same time one of the most commendable, of the acts of the Forty-seventh Congress was the passage of House bill No. 5,066, appropriating $10,000 to be expended under the direction of the Commissioner of Patents in the preparation of a classified abridgment of all the letters patent of the United States.

Such a work has long been needed, both in the Patent Office and out of it. Indeed for lack of it the efficiency of the Office has been materially diminished for many years; while an incalculable amount of wasted time and thought and money is traceable to the inability of inventors to discover what previous investigators have accomplished, or where they have failed, in the same lines of effort.

Last year more than 7,000 applications for patents, many of them representing, no doubt, years of patient investigation, were rejected for lack of novelty. A large part of the labor and cost which such reinventions entailed might have been saved, and many other more successful efforts might have been facilitated, had our inventors been furnished with the knowledge locked up in the Patent Office awaiting the key which is now provided for. And the 7,000 disappointed inventors represent probably but a small fraction of those who, during the past year, were engaged in more or less fruitless efforts to advance the useful arts.

This waste of intellectual energy and useless expenditure of means by a class which could least afford to spare them has been going on for a long generation. In his annual report for 1848 Commissioner Ewbank urged upon Congress the grave need of an index of patents, such as has now been tardily promised. At that time the number of rejected applications did not reach a thousand a year, yet the Commissioner could then justly say of the digest asked for:

"In a pecuniary point of view such a work is most desirable to this Office, to inventors, and the public at large. When made accessible to popular reference it will be the saving of millions. No State paper could surpass it in importance, nor in lasting value. Till it is done a majority of applicants for patents must continue to meet with some disappointment. The only safe rule with them is always to make themselves acquainted with what has been attempted before incurring any serious outlay. They should never presume that their devices have not entered other heads than their own until, by a searching inquisition on every hand, the presumption remains in their favor unimpaired. No better advice than this can be given them. But how are they to follow it? Nineteen-twentieths have few or no reliable sources of information within their reach, and not one in a hundred can afford the expenses of a visit to Washington and a residence there for the purpose of consulting the Office records and library."

For thirty years and more this grievous barrier has lain at the very threshold of invention—thirty years, during which the world has been revolutionized and the scope of human life increased enormously by the successful efforts of inventors. Who can estimate the evil which has directly and indirectly resulted from the long neglect to do justice to the Patent Office, to inventors, and still more to the general public, which, more than all the rest, is to be benefited by the work of the inventor and the highest efficiency of the patent system?

It is to be hoped that there will be no delay in the prosecution of the work of preparing and printing the digest which the new law provides for; and that, when printed, the work will be made easily accessible to every man who may wish to consult it.

THE BARGE SYSTEM ON THE MISSISSIPPI.

Mention was made in this paper recently of the sailing of a fleet of barges from St. Louis with over 10,000 tons of grain (20,847,900 pounds) for export by way of New Orleans. The fleet was towed by the steamer Oakland, which took, in addition to the eight grain barges, a capacious fuel barge. The largest tows last year were as follows: The Iron Mountain and barges left St. Louis, April 10, with 300,000 bushels of corn, or 16,800,000 pounds cargo. The same boat and barges, February 29, with 47,000 bushels of wheat and 210,228 bushels of corn, or 14,392,768 pounds. The D. Gilmore, July 17, with 178,000 bushels of wheat and 30,000 bushels of corn, or 13,860,000 pounds; and the Oakland, August 10, with 230,158 bushels of wheat.

The shipments from St. Louis by barges for European account last year reached a total of 15,717,664 bushels of wheat, corn, and rye. The shipments of the same sort in 1870 comprised only 66,000 bushels of wheat.

The prospect of an extension of the operations of the St. Louis and New Orleans barge line to Davenport, Iowa, next summer has led the *Democrat*, of the latter city, to investigate the progress and prospects of the barge system. It finds that at the close of 1880 there were four lines of towboats and barges engaged in transportation, aggregating 15 boats and 86 barges, with a total capacity in bushels of 4,690,000 and 4,200,000 per month to New Orleans. The boats and barges now building number 1 boat and 24 barges—of the latter, 22 having a capacity of 60,000 bushels each and 2 of 50,000 each, which will increase the total capacity to 6,000,000 bushels. There are now four established barge lines from St. Louis to New Orleans for the transportation of grain for export, and three of them are making the additions referred to above. The four rank as follows in present and building capacity: Mississippi Valley Transportation Company, 7 boats and 49 barges, with a total capacity of 2,520,000 bushels; St. Louis and New Orleans Transportation Company, 6 boats and 50 barges, with a total capacity of 2,550,000 bushels; the Anchor Line Company, with 2 boats and 12 barges, and a total capacity of 500,000 bushels; and the M. C. T. Company, with 1 boat and 9 barges, of 540,000 bushels capacity. The trips of the tows of these lines last year from St. Louis direct numbered 113, and these transported 5,913,272 bushels of wheat and 9,804,392 bushels of corn, including 45,000 bushels of rye. The number of barges to a tow would be about five, and the average cargo of each trip for the year 140,000 bushels.

All this vast trade has been made possible by the improvements of the channel of the Mississippi below New Orleans, particularly by the jetty system at the mouth of the river.

LARGE CRAFT ON THE LAKES.

When the Congressional committee had under consideration last winter the question of appropriation for the improvement of the harbor at Chicago, the *Inter-Ocean* of that city remarked that while eleven feet of water in Chicago River sufficed for the commerce of a few years ago, from fifteen to seventeen feet were needed now, to accommodate craft carrying from 50,000 to 70,000 bushels of grain.

Seven or eight years ago a craft of 600 tons was considered large on the lakes; now Chicago alone owns many that are twice and three times as large. A list printed in the paper mentioned gives the names, tonnage, and values of nearly fifty vessels ranging between 800 and 1,000 tons, and more than fifty having a capacity exceeding 1,000 tons. Of these fifteen propellers are rated between 1,500 and 2,000 tons, and one at 2,082 tons. The values of these vessels range between $60,000 and $125,000. At the same time there were on the stocks at the different lake ports forty vessels of 2,000 tons and over, several ranging between 2,500 and 2,800 tons.

One of the latter, having a carrying capacity of 80,000 bushels of grain, was lately launched at Cleveland. Its dimensions are given as follows: Keel, 355 feet; beam, 38 feet; hold, 20 feet. It is a propeller, employing two compound engines, the cylinders measuring 48 x 48 and 22 x 48 respectively. The two boilers are each 10 feet in diameter and 17 feet long.

Another vessel soon to be launched at Toledo measures as follows: Length of keel, 265 feet; length over all, 278 feet; breadth of beam, 38 feet 9 inches; hold, in shallowest place, 21 feet, in deepest place 24 feet 8 inches. She will be five

masted and will carry 5,500 yards of canvas. Her cost is estimated at $95,000, and her carrying capacity will be, full draught, 140,000 bushels; 14 feet 6 inches draught, from 90,000 to 95,000 bushels of corn. There is a decided recent movement in the direction of iron vessels for the lake service.

WATER SUPPLY OF CINCINNATI.

We are indebted to Charles F. Klayer, Esq., member of the Board of Health of Cincinnati, Ohio, for a copy of a recent report of the Sanitary Committee, made to the Board of Health, on the public water supply of the above city. Most of the city water is taken from the Ohio River, but other sources are made use of, namely, springs, wells, and cistern water. A growing suspicion on the part of the public that the sewage of the city, owing to the rapid increase of population in the vicinity of the pumping works, was injuring the purity of the water, led to the appointment of a committee of examination. The analyses of the water established the unwelcome fact that the sewage of the city seriously contaminates the river water supply. One reservoir however, at Markley Farm, twelve miles from Main street, was found to furnish water of good quality—as good as the Croton water, New York. The report shows that waters exposed to atmospheric air contain naturally about one pound to one and one-half of sewage to the million gallons.

On this basis the general conditions of comparison are as follows:

Croton water, New York City	0·98	lb.	sewage to the	1,000,000	gal.
Loch Katrine, Glasgow	0·66	"	"	"	"
Thames, London supply	0·50	"	"	"	"
Mystic River, Boston, Mass.	1·83	"	"	"	"
Fresh Pond, Cambridge, Mass.	1·50	"	"	"	"
Fairmount, Philadelphia	1·58	"	"	"	"
Cincinnati	3·33	"	"	"	"

For better water supply for Cincinnati it is suggested in the report that wells might be sunk in the sand beach alongside the river bank at Dayton, Ky., where, by means of 116 tube wells, 20 inches in diameter and 20 feet deep, and a water main 3,000 feet long, a new supply of superior water filtered through the sand to an extent of fifty million gallons daily, can be obtained.

An interesting supplementary report by C. R. Stuntz, M.D., on the analyses and value of cistern water for domestic purposes, the impurities it contains, how it becomes contaminated, etc., is presented. Those who think that cistern water is the only proper liquid for domestic use, may have occasion to change their notions after reading this report, which we give in full in SCIENTIFIC AMERICAN SUPPLEMENT, No. 275. It is accompanied with rules for the proper location and care of rain-water cisterns, which should be read and practiced by all who depend on this system.

The Cost of Coal Gas.

Mention has been made in this paper of the evidence given by Mr. Kennedy, in the Philadelphia Gas Trust inquiry, touching the manufacture of coal gas. More recently he has been on the stand again, and, in answer to the question, What should be the cost of gas in the holder? has given the following statement of cost of 1,000 cubic feet of gas of 16 candle power, the price of coal being $4.80 per 2,000 pounds:

Coal	$0.44.9
Labor	.15.8
Lime	.01.2
Renewal of retert settings	.02.2
Disposition of *debris*	.00.6
Water supply	.00.3
Consumption of gas in works	.00 3
Supplies	.00.7
Repairs	.01.5
Contingencies, expenses, and improvements	.06.2
	$0.73.7
Sale of coke at $2.50 for 36 bushels, to be deducted	.11.7
Net cost	$0.62.0

Mr. Kennedy explained that he calculated to make 5 feet of gas to the pound of coal, by adding 10 per cent of cannel coal at $10 per ton, and he credited the coal with 30 cents a ton for the residual products, 20 cents for tar, and 10 cents for ammoniacal liquor.

Dangerous Toy Torpedoes.

A serious explosion in a toy torpedo factory lately took place in Brooklyn, N. Y., caused by the accidental upsetting of a dish containing a quantity of explosive pellets. The building was a two story brick. The walls were blown out and seven persons badly injured. These torpedoes were composed of red phosphorus, chloride of potash, sulphur, and sulphate of lime. A pill of this mixture, the size of a pea, is placed, with a thimbleful of sand, in a bit of colored tissue paper and twisted up. This constitutes a torpedo which, when thrown on the ground, explodes with a sharp crack. The manufacture is very dangerous, and the making or selling within city limits should be prohibited by law. There are plenty of instruments with which boys may satisfy their instincts for making noises without resort to deadly explosives.

French Exhibition of Electricity.

Mr. George Walker, our Consul-General in Paris, was, up to the time of his appointment, connected with the Western Union Telegraph office of this city, and is therefore likely to be more interested in electrical matters than most consuls. Mr. Walker has communicated to our government the decree which the French Government have passed convoking an international congress of electricians to be held in Paris on the 15th of September, 1881, and closes his report as follows:

"While the subject of these decrees will come officially and formally before the Government of the United States through its Minister at Paris or the Minister of the French Republic at Washington, I venture to think that the matters to which they relate fall strictly within the range of those commercial and industrial facts which it is made the duty of consular officers to communicate to the government. In this sense I may be permitted to express the hope that the country which gave birth to Franklin, to Morse, and to Henry, and which is now the home of Gray, of Edison, and of Bell, will not neglect to participate in the proposed congress of electricians, and to impress upon it those scientific ideas in relation to one of the greatest forces which modern discovery has furnished to the world, which have received such a remarkable and rapid development in our own country."

THE REESE CIRCULAR SAW.

The Reese circular saw, it will be remembered, consists of a circular smooth-edged iron plate, which will cut in two, without touching it, a bar of steel placed in front of it and revolving in an opposite direction. The statements which have been made in the American and English papers in regard to this apparatus having been questioned by French writers, Mr. Reese has recently written a letter to one of the latter, Mr. L. Baele, giving his theory in regard to the operation of his saw. This letter, translated into French, was communicated to our contemporary, *La Nature*, from which we again translate it into English. It reads as follows:

PITTSBURG, December, 1880.

L. BAELE, ESQ.:

The interest that scientists are manifesting in my circular saw by reason of its faculty of cutting steel bars without touching them, leads me to call your attention to a much more wonderful phenomenon yet that I have always observed in studying the operation of this apparatus. And allow me to say to you that for this saw, of which I hold the patent, there is paid to me a royalty of $1,000 on each one used. You see, then, that it is really a practical and useful apparatus.

When the bar to be cut is brought near the disk in motion the metal immediately melts, and there escapes a current of sparks of a dazzling whiteness. Yet one's hand may be placed in this stream of molten metal without its being in any way burnt; and the temperature is even but little different from that of the surrounding atmosphere. A sheet of white paper placed therein would not take fire, and would not even be discolored; and it would be the same with a piece of cotton wicking soaked in oil if it were placed in the current not far from the bar to be cut. Besides the drops of molten metal which fall thus to the ground a certain number are projected sideways in all directions. The sparks which thus pass in the atmosphere over a space of more than five feet become rapidly heated and burn like a hot poker. In America it is from France and Germany that we expect the solution of questions of abstract science. What scientist, versed in the study of molecular physics, can give us the explanation of so wonderful a phenomenon? The comparatively cold sparks burn like a hot poker, while the glistening incandescent molten mass will not burn at all, and will not discolor white paper.

The fusion saw is a circular iron disk, 42 inches in diameter and two-tenths inch thick. It is mounted on an arbor like an ordinary circular saw, and put in motion by the aid of pulleys and belts. It is given a velocity of 2,800 revolutions per minute, representing at the circumference a tangential velocity of 25,250 feet. Then the cold steel bar which is to be cut is placed in front of the disk and made likewise to revolve, with a speed of 200 revolutions per minute.

Under these conditions as soon as the bar arrives in proximity to the disk there is produced on its surface a little drop of molten metal, and a few seconds afterward a notch, and this without the disk ever having touched the bar. The rotary motion of the bar facilitates the flow of the molten metal, and the separation of the metal never takes place by contact, but only by melting. All bodies melt, as well known, at a suitable temperature; but is not this temperature a perceptible measure of the velocity of the molecules in their movements in the interior of bodies? So long as this velocity is kept within certain bounds the body remains in a solid state; but if it exceeds these, the molecules then flow off in a liquid state—fusion takes place. Then if, going yet further, we increase the velocity of the molecules we arrive at the gaseous state. Fusion is thus produced, then, without any contact, and the only condition necessary is to bring the molecules up to the requisite velocity. The pressure of the atmosphere perceptibly increases, as you have pointed out in the description of the apparatus, on each surface of the disk, and may even attain during the experiment 1·02 atmospheres. The molecules of air are thrown, in fact, in directions divergent to the velocity of 25,250 feet per minute, and there takes place a certain increase of intermolecular distances at the same time with an absorption of latent heat. The gaseous particles thus projected strike against the bar with the *velocity of fusion*, and under the influence of these multiplied shocks and of the compression which results therefrom, the latent heat, which has become free, is transmitted into the bar of steel, brings the metallic molecules to the velocity of fusion, and in this region the metal flows off in a liquid state.

Some years ago I heard Mr. Tyndall say in one of his lectures, "Temperature is the measure of molecular velocity, as gravity is the measure of matter," and I thought then that it would be possible to make a practical demonstration of this theoretical idea. I was then led to construct the fusion saw, and to my great satisfaction I beheld the little drops of liquefied metal flow off at the velocity of fusion.

In conclusion, I think that this imponderable agent which escapes our senses, and which we call heat, is the same which, in being transmitted through gases, communicates to molecules the velocity which renders them luminous, just as it can bring those of solid bodies to the velocity of incandescence; and when it is obliged to exert its action upon a contracted space it is also that which produces the phenomenon that we attribute to electricity. Yours truly,

JACOB REESE.

American Butter in Ceylon.

The American Consul at Ceylon, Mr. Morey, deprecates the packing of butter in tin for shipment to warm climates. He states that butter arriving at Ceylon from the United States thus packed has become deteriorated from the corrosion of the tin, or the use of impure salt used in the packing, and that there is not only a loss to the importer, but he implies that it naturally brings a discredit upon the producer and our nation. He says: "The French are sending to the East large quantites of Normandy butter, in one and two pound bottles, with mouths about two inches diameter, glass stoppered, and secured with hard, white cement, so as to be perfectly air-tight. The butter is fresh; but after being packed, about one tablespoonful of white pearly salt, almost impalpably fine and exquisitely pure, is put into the neck of the bottle, and the stopper applied. This butter retails almost unlimitedly at 65 cents gold per one pound bottle, and 55 cents per pound in two pound bottles. As our country has now become famous for its excellent glass, and there can be no question about the conservation of butter in vessels formed of that material, I see no reason why our exporters should not only imitate the French in using it for packing butter, but for cheese also, thereby securing preservation, and a never-failing market for those commodities in this oriental hemisphere."

A New Entozoon in the Ostrich.

A serious plague among young ostriches has been spreading over South Africa during recent years. A *post mortem* examination made by Mr. Arthur Douglass discovered the trouble to arise from the presence of myriads of small thin worms adhering to the coats of the ostrich's stomach. Specimens were sent to Dr. Spencer Cobold, of London, who pronounced them unknown to science, and named them *Strongylus douglassii*. The importance of the discovery may be estimated from the fact that ostriches are worth from $750 to $900 a pair, while the ostrich industry is a source of great revenue to South Africa. The cause of the plague being known some means of destroying the parasite may be looked for.

The Denver Mining Exhibition.

Substantial progress appears to be making toward the establishment of a permanent exhibition of mining appliances, ores and other minerals, at Denver, Colorado, next September. An exposition company has been organized, and forty acres of land have been secured whereon it is proposed to erect a building to cost 250,000. A considerable part of the needed money has already been subscribed.

Mr. Clarence King has promised to loan one set of specimens from the triplicate geological collection which is now being made under his direction. It is intended that this exhibition shall display every natural fact and every artificial process known to mining engineers. It will be distinctly national in its character, but collections, machinery, illustrations, and treatises from abroad will be welcomed.

Lacquers for Brass.

1. Seed lac, dragon's blood, annatto, and gamboge, each 4 ounces; saffron, 1 ounce; wine spirit, 10 pints.

2. Turmeric, 1 pound; annatto, 2 ounces; shellac and gum juniper, each 12 ounces; wine spirit, 12 ounces.

3. Seed lac, 6 ounces; dragon's blood, 40 grains; amber and copal triturated in a mortar, 2 ounces; extract of red sanders, ½ drachm; Oriental saffron, 30 grains; coarsely powdered glass, 4 ounces; absolute alcohol, 40 ounces. (Very fine.)

4. Seed lac, 3 ounces; amber and gamboge, each 2 ounces; extract of red sanders, ½ drachm; dragon's blood, 1 drachm; saffron, ½ drachm; wine spirit, 2 pints 4 ounces.

5. Turmeric, 6 drachms; saffron, 15 grains; hot alcohol, 1 pint; draw the tincture and add: gamboge, 6 drachms; gum sandarac and gum elimi, each 2 ounces; dragon's blood and seed lac, each 1 ounce.

6. Alcohol, 1 pint; turmeric, 1 ounce; annatto and saffron, 2 drachms each. Agitate frequently for a week, filter into a clean bottle, and add seed lac, 3 ounces. Let stand, with occasional agitation, for about two weeks.

7. Gamboge, ½ ounce; aloes, 1½ ounce; shellac (fine), 8 ounces; wine spirit, 1 gallon.

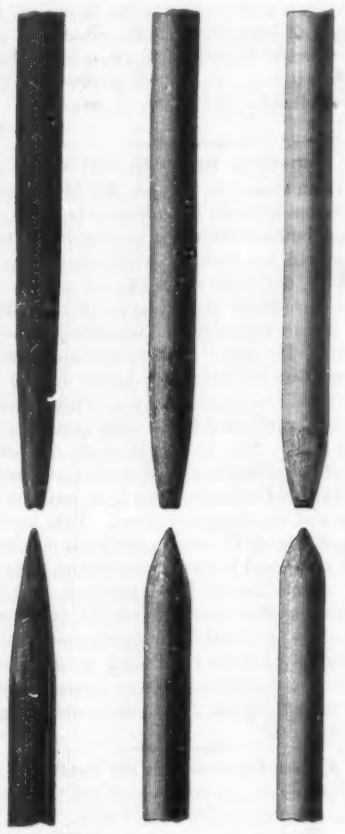
From half an acre of land at Bristol, R. I., Mr. Arthur Codman gathered last year 6,300 pounds (126 bushels) of grapes, some clusters weighing a pound and a half each, and all perfectly ripe. The vineyard contains 550 Concord vines, twelve years old, and kept low and closely pruned. The grapes yielded 580 gallons of wine.

COMPARATIVE EXPERIMENTS MADE WITH NAKED AND METALLIZED CARBONS.

BY E. REYNIER.

These experiments were made at the works of Lautter & Lemonier, using a Gramme machine of the type of 1876, and burning Carré carbons. The positive carbons covered with copper gave a very good shape, and an excellent one when covered with nickel; with the negative carbon the shape was

Fig. 1. Fig. 2. Fig. 3.



Dimensions	State of the surface.	Consumption per hour in millimeters.			Length of the consumed part in millimeters.		Light in Carcel burners.
		+	−	Total.	+	−	
Diam., 7 millimet'r	Naked, Fig. 1 ...	166	68	234	53	23	947
	Coppered, Fig. 2..	146	40	186	24	10	?
	Nickeled, Fig. 3..	106	38	144	12	7	947
Diam., 9 millimet'r	Naked	104	50	154	45	22	523
	Coppered.....	98	34	132	27	7	553
	Nickeled	68	36	104	21	7¼	516

a little too short when nickeled. Independently of the improvement of the shape of the positive carbon, the nickel increased the duration of carbons nine millimeter diameter *fifty per cent* and those of seven millimeter *sixty-two per cent*. The coppered carbons thus occupy a position mid way between the naked carbons and the nickeled ones.

For equal section the metallization does not modify the illumination.

Among the refractory metals nickel is to be preferred, especially for the positive pole (iron being very difficult to apply in thin coats).

The figures represent the shapes of the naked and metallized carbons: Fig. 1, the naked carbons; Fig. 2, copper covered; Fig. 3, those covered with nickel.—*Translated from La Lumière Electrique, by Clarence Sterling.*

TYNDALL'S EXPERIMENT ON RADIANT HEAT.

BY GEO. M. HOPKINS.

In the entire range of Prof. Tyndall's investigations nothing possesses more timely interest (or affords a better test of the possible sufficiency of cheap appliances) than his recent experiments for testing acoustically the capacity of vapors and gases to absorb radiant energy.

It often happens that students who would like to test experimentally the results arrived at by distinguished investigators, are kept from such instructive pleasures by the notion that for delicate experimenting nice and expensive apparatus is required. Such apparatus is undoubtedly good to have and pleasant to work with; but where it is not to be had a little courage and ingenuity may provide cheap substitutes which will amply answer the student's purpose. The rude apparatus, herewith figured, illustrates this fact.

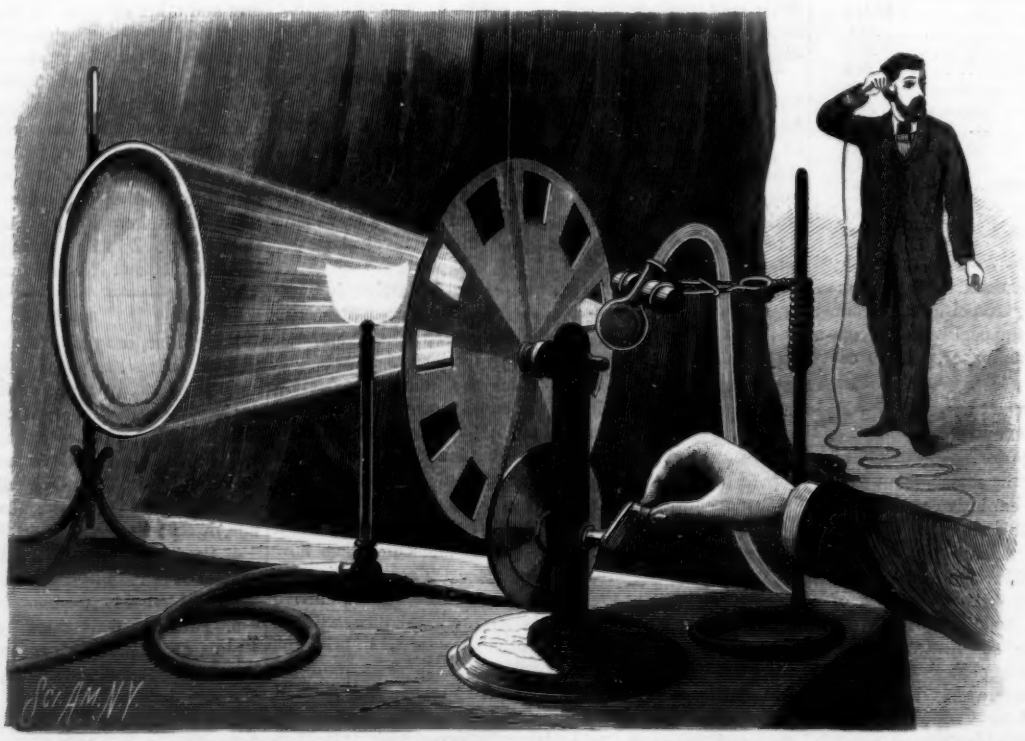
The interesting experiment referred to seems to have been suggested by Prof. Bell's photophonic experiment in which musical sounds are obtained by the action of an intermittent beam of light upon solid bodies. Referring to this, Prof. Tyndall says:

"From the first I entertained the opinion that these singular sounds were caused by rapid changes of temperature, producing corresponding changes of shape and volume in the bodies impinged upon by the beam. But if this be the case, and if gases and vapors really absorb radiant heat, they ought to produce sounds more intense than those obtained from solids. I pictured every stroke of the beam responded to by a sudden expansion of the absorbent gas, and concluded that when the pulses thus excited followed each other with sufficient rapidity, a musical note must be the result. It seemed plain, moreover, that by this new method many of my previous results might be brought to an independent test. Highly diathermanous bodies, I reasoned, would produce faint sounds, while highly athermanous bodies would produce loud sounds—the strength of the sound being, in a sense, a measure of the absorption. The first experiment, made with a view of testing this idea, was executed in the presence of Mr. Graham Bell, and the result was in exact accordance with what I had foreseen."

I have successfully repeated Prof. Tyndall's experiment with the simple apparatus shown in the illustration, and have verified the results obtained by him. Utilizing apparatus already at hand, I mounted a small sized bulbous glass flask, 1¾ inches in diameter, in a test-tube holder, and placed it behind a rotating pasteboard disk, 12 inches in diameter, having twelve apertures 1⅛ inches wide and 1¼ inches long. I provided several flasks of the same capacity, and filled them with the different gases and vapors, and stoppered them, to be used at convenience. Near the disk I placed a common gas flame, and into the mouth of the flask was inserted one end of a long rubber tube, the other end being provided with a tapering ear tube, placed in the ear of the listener, whose position was sufficiently remote from the apparatus to avoid any possible disturbance from the revolving disk or the operator. The disk being rotated so as to rapidly intercept the thermal and luminous rays of the gas flame and render the rays rapidly intermittent, the effect on the gases and vapors contained by the different bulbs was noted. Dry air produced no sound; moistened it yielded a distinctly audible tone, corresponding in pitch with the rapidity of the interruptions of the thermal rays.*

Among gases tried, nitrous oxide and illuminating gas yielded the loudest sounds. Among vapors, water and sulphuric ether were most susceptible to the intermittent rays. A candle flame produced distinctly audible sounds in the more sensitive gases, and a hot poker replacing the gas flame yielded the same results.

By using an ordinary concave spun metal mirror the heat of the flame was satisfactorily projected from a considerable distance. Considering the crudeness of my apparatus and the delicacy of the action which produces the sounds, it appears remarkable that any satisfactory results were obtained, and the experiment shows that any one interested in the finer branches of scientific investigation may often, with the exercise of a little care, enjoy, without material expense, those deeply interesting experiments. I have not recounted, at length, the details of Prof. Tyndall's experiments in this direction, as they are fully given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 272, of last week, and are, therefore, accessible to the reader.



APPARATUS EXHIBITING THE ACTION OF RADIANT HEAT ON GASEOUS MATTER.

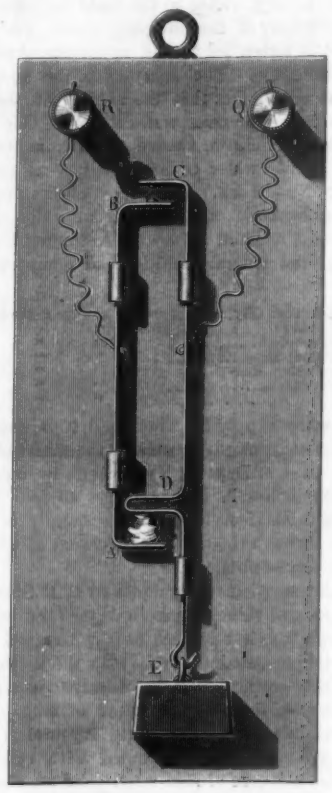
* The tone to be expected from the gas or vapor when acted on, may be determined by blowing through a tube against the apertured portion of the rotating disk.

Lamp of 100,000 Candle Power.

A Brush electric lamp of 100,000 candle power was successfully tested in Cleveland, Ohio, March 6. This is fifty times the illuminating power of the ordinary street electric lamp. It is the largest and most powerful lamp ever made, and is to be used in the British Navy. The carbons are two inches and a half in diameter. The light requires 40 horse power to maintain it.

ELECTRICAL FIRE INDICATOR OF M. G. DUPRE.

A large number of electrical fire indicators have been devised and constructed, but the one represented in the engraving is one of the simplest and most practical of any that we have examined.



ELECTRICAL FIRE INDICATOR.

It consists of a small mahogany board upon which are arranged two small copper rods, one, A B, fixed, connected with the binding post, R; the other, C D, movable, connected with the binding post, Q, and supporting a weight, E. A battery and bell are inserted between the binding posts, R and Q, and a small lump of tallow is placed between the horizontal bends of the rods, the movable rod, C D, resting upon it.

When the temperature of the locality where the apparatus is placed rises above the melting point of tallow it melts, and the movable rod descends under the action of the weight, E. An electrical contact is then established between the two branches, B and C, and the bell is set in motion.

By replacing the tallow with any other fusible non-conducting material the apparatus may be employed to indicate the precise instant when a given temperature is reached.

A metallic substance may be placed between the points, A and D, the fusible metal of Darcet, for example, on condition that the rod, A B, be cut at some point in its length, in such a manner as to interrupt all metallic communication between the two parts of the rod.

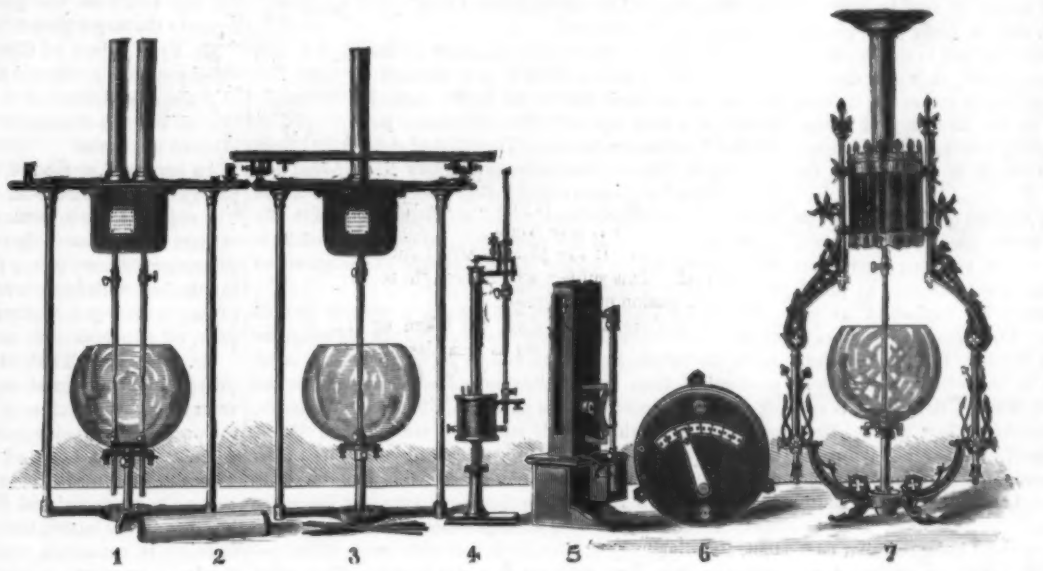
The apparatus is simple, inexpensive, compact, and may be used in connection with the domestic batteries and bells without other adjunction to the apparatus, because when the temperature at which the apparatus is set has been reached the bell will sound until the fusible substance has been replaced, and consequently those interested have been duly informed.

A system of this kind has been in use by M. Hellesen, of Copenhagen, for a number of years.—*La Lumière Electrique.*

AMERICAN INDUSTRIES.—No. 69.

THE BRUSH ELECTRIC LIGHT.

The most difficult problems in electric lighting have been: (1). To provide an efficient and economical means of converting mechanical power into electric energy, that is, a good dynamo-electric machine. (2). To devise a generator able to evolve an electric current capable of subdivision, to supply a series of lamps in one circuit. (3). To invent a self-regulating lamp adapted to such an electric circuit, and so constructed that any accidental disturbance of it, or its extinction, would have no effect upon the other lamps in the same circuit. The lamp to be at the same time easy to keep in order, durable, and economical in power. (4). To discover an automatic method of regulating the supply of electricity so that the current would be always exactly equal to the varying requirements of the circuit. Up to 1876, when Mr. Brush produced his first dynamo-electric machine, a large number of scientific investigators and mechanical inventors had been at work upon these problems. Individually and together they had accomplished much, but there was yet no machine that could be considered a commercial success, and no lamp —certainly no system of electric lighting—that had passed beyond an experimentally promising stage. There was no machine that could furnish a current for a number of lamps, much less sustain them in one circuit with steadiness and uniformity.



1. Double Lamp.—2. Carbons.—3. Single Lamp —4. Focusing Lamp.—5. Head-light Lamp.—6. Dial Attachment to Machine.—7. Ornamental Lamp.

BRUSH ELECTRIC LAMPS.

Very soon after Mr. Brush entered the field, he presented to the public an apparatus which was free from the defects of all other systems, and the public, waiting for just such an apparatus, welcomed the new machine, and the result is that to-day the Brush Electric Light is practically the sole occupant of the field; at least forty-nine out of every fifty lights that have been sold in this country being Brush lights. Up to the present time over 6,000 Brush lights have been sold for regular industrial use, and the business has only just opened. An idea of the great superiority of the Brush system of lighting may be obtained from the fact that with the largest sized Brush machine forty powerful electric lights are burned in one circuit, with an absorption in the machine of thirty-six horse power. We believe that no other system of lighting can maintain one-fifth of this number of lights on one circuit; and most are confined to a single light to one machine.

Although the Brush electric light has been introduced on an extended scale in other cities, it is only recently that it has been brought to the city of New York; but notwithstanding the tardiness of its appearance here, it is being largely introduced and used by both private individuals and the public.

Our large illustration represents the lighting station of the Brush Electric Illuminating Company of New York, at 133 and 135 West 25th street, and also shows a portion of Broadway between 14th and 34th streets, as it appears at night illuminated by twenty-one Brush electric lights.

In the same illustration we give a view of the immense factory of the Brush Electric Company at Cleveland, Ohio; also views of some of the lamps. The parent company at Cleveland controls the manufacture and sale of all of Mr. Brush's patented inventions relating to electric light or electro-plating apparatus and supplies.

The genius of the inventor of this system, and the energy and good business management of the Brush Light Electric Company of Cleveland, have done more since 1876 to place the business of illumination by the electric light upon a practical and substantial basis than has been done in this direction by all other inventors since the discovery by Faraday, at least so far as voltaic arc lights are concerned.

In every sense the Brush electric light is a practical, commercial success, and is no longer an experiment. No better proof of this could be required than the well known fact that no one can buy a Brush machine or lamp at less than regular prices. Makers of other machines may offer inducements of every kind, in the way of large discounts from regular prices, the privilege of a trial with no obligation to purchase, long deferred payments, etc., etc.; but the Brush Company takes the same ground held by George H. Corliss in regard to engines, and claims that the apparatus they furnish is no longer experimental, that it is well worth the price asked for it, and should not be compared with merely experimental systems whose principal recommendations are that they can be bought at the purchaser's own price, and may be returned if not satisfactory.

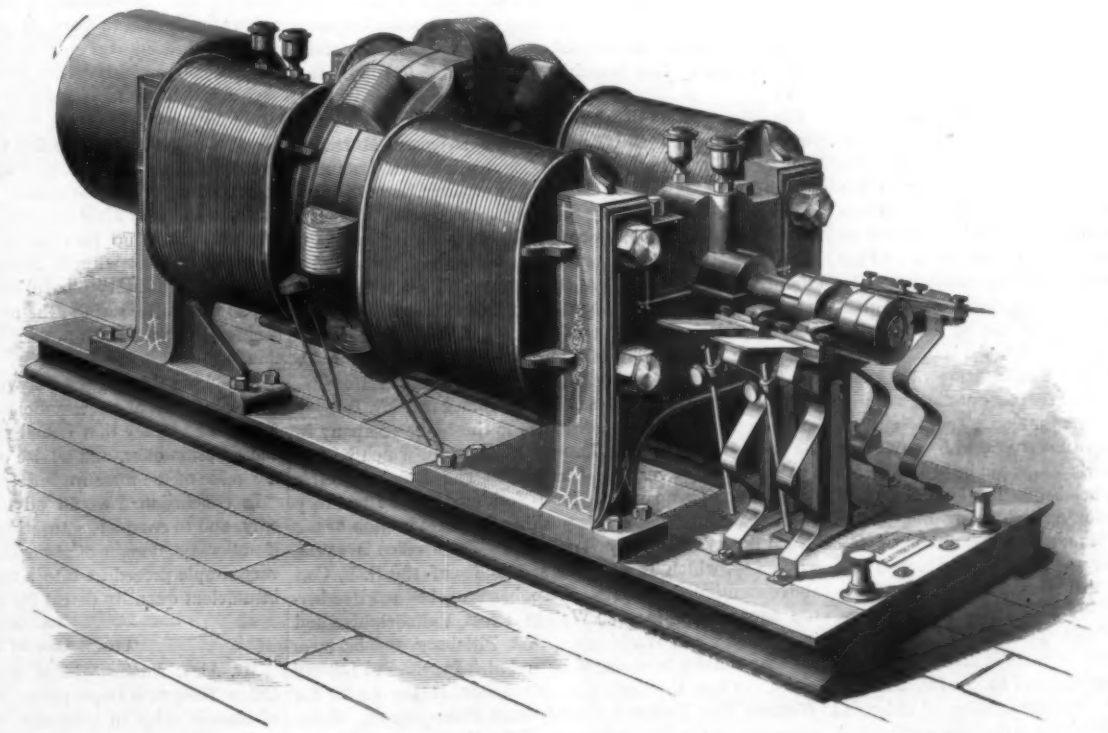
Not only has the Brush light practically monopolized the field in this country, but, if we may judge from reports, it is also rapidly doing the same abroad. It has made wonderful advances in England, where it is controlled by the Anglo-American Brush Electric Light Corporation, Limited, having a capital of $4,000,000. One year ago this company bought the English patents of Mr. Brush at a very large price, and we understand they have recently purchased all his other foreign patents—those for France, Belgium, Austria, Russia, Italy, Spain, Norway, Sweden, Denmark, etc., paying for them still larger prices than they paid for the English patents, and they now propose to commence the introduction of the Brush light into all these countries in the same business-like and thorough manner which has characterized its management from the first. The sums paid for these foreign patents are, it is claimed, greater than have ever been paid for any other foreign patents obtained by an American. As rapidly as arrangements can be made the Brush light is being introduced into every civilized country on the globe, and it seems to have found a field in every branch of industry, and in almost every imaginable situation, as the following partial list of users indicates:

There are 800 lights in rolling mills, steel works, shops, etc.; 1,240 lights in woolen, cotton, linen, silk, and other factories; 425 lights in large stores, hotels, churches, etc.; 250 lights in parks, docks, and summer resorts; 275 lights in railroad depots and shops; 150 lights in mines, smelting works, etc.; 380 lights in factories and establishments of various kinds; 1,500 lights in lighting stations, for city lighting, etc.; 1,200 lights in England and other foreign countries. A total of over 6,000 lights which are actually sold, none of them being on trial.

This system, we believe, is the only one by which a large number of powerful electric lights can be burned in series, upon a single circuit of wire, with steadiness and uniformity. The machine known as No. 8 maintains forty lights of 2,000 candle power each, upon a circuit ten miles in length of copper wire No. 6 English gauge. By using still larger wire the distance or length of circuit may be proportionately increased, it being possible to extend the circuit to twenty-five miles by using No. 1 wire. The smaller sizes of Brush machines are fully as efficient. A No. 7 machine is used in Montreal to light the harbor on a circuit of about three miles, using sixteen lights. Another peculiarity and advantage possessed by the system is that any number of lights desired, from one up to the number capable of being maintained by the machine, can be burned in circuit from the machine without changing its speed or adjusting the lamps.

Each lamp of the Brush type is provided with an automatic cut-out, which is one of the valuable features of the system. If from any cause a lamp in circuit becomes deranged so that its carbons do not feed together properly, or if the carbons need renewing, the cut-out mechanism is called into action and this particular lamp is switched out of circuit without disturbing any other lamp in use. When this lamp has been supplied with carbons again and put in order it will burn as before. This simple cut-out mechanism effectually guards against all the dangers of general extinction of lights, a thing liable to occur in all other systems. We believe that no other system uses a cut-out.

When it becomes desirable to operate lamps more than seven or eight hours continuously, the double lamp shown in our large illustration is used, and two sets of carbons are employed. Both carbon rods are actuated by a single magnet, the same as that employed in a single lamp, and they are so arranged that when one set of carbons is completely consumed, the other set is automatically switched into circuit. In practice the transfer of the voltaic arc from one set of carbons to the other is instantaneous and scarcely noticeable. By means of these double lamps a system of lights may be maintained in continuous operation from fourteen to sixteen hours without requiring any attention, whereas other systems are limited to six or eight hours' continuous burning



BRUSH DYNAMO-ELECTRIC MACHINE.

The great simplicity and durability of the machines are points of importance in considering the wear and tear from constant use. The experience of the four years shows that one per cent allowance for wear and tear is ample to cover, and that with even a less amount annually spent upon the machines they will last indefinitely.

The business of the Brush light on Manhattan Island is in the hands of the Brush Electric Illuminating Company of New York, a corporation organized under the laws of the State, with a capital of $1,000,000. The officers are: W. L. Strong, President; A. D. Juilliard, Vice President; A. A. Hayes, Jr., Secretary; S. B. Sturges, Treasurer; C. M. Rowley, General Manager; R. J. Sheehy, Superintendent.

The first lighting station of the company is at Nos. 133 and 135 West 25th street. It contains at present five dynamo-electric machines, the largest of which is 89 inches long, 28 inches wide, and 36 inches in height, and weighs 4,800 pounds, and runs at a speed of about 700 revolutions per minute. It is believed to be the largest machine in the

world. Forty lights are fed by it, and it requires 36 horse power. Several circuits are connected with this station, one exclusively for lighting parks and streets. Broadway, from 14th to 34th street, is lighted from there. Among buildings in this district are the Sixth Avenue Elevated Railroad, the Sturtevant House, the Gilsey House, the Standard Theater, Daly's Theater, the Bijou Theater, the Aquarium, Aberle's Theater, Koster & Bial's, the *Herald* office, and many others. The company runs wires from this station to any point within a radius of two miles, putting up the light in any desired place, and renting in the same manner as is done with gas.

The street lighting is done by means of double lamps on iron posts twenty feet in height, and in plain glass globes. It is proposed to extend this materially and to use the larger lights, elevated on poles, for open spaces, as is now done in the West. This company has had much success in lighting large buildings for balls, such as the Academy of Music, Madison Square Garden, etc., using opal and lemon colored globes, giving a hue to the light which is approved by the fair sex.

The establishment of lighting stations in cities and towns for the illumination of streets, parks, open spaces, depots, docks, stores, hotels, factories, etc, is enlisting very large amounts of capital, and promises to be a business as profitable and as eagerly sought after by capitalists as gas companies have been heretofore. Companies have already been formed, or are about to be formed, for the establishment of such lighting stations in the following cities and towns: New York, Philadelphia, Boston, Baltimore, Washington, Providence, Albany, Hartford, New Haven, Meriden, Rochester, Buffalo, Cleveland, Cincinnati, Dayton, Indianapolis, Columbus, Middletown, Detroit, Grand Rapids, Chicago, St. Louis, Denver, Salt Lake City, Ogden, Butte, San Francisco, etc.

It is only a question of a few months before similar companies will be formed, and similar lighting stations established in every city and town of any pretensions in the country. In all of the above places the Brush light is to be exclusively used.

The general plan of operations in all these lighting stations will be similar to the one in New York, which, briefly described, is as follows: A location is first selected as central as possible with reference to the territory to be lighted; sufficient space must be provided for engines, boilers, heater, pumps, shafting, belting, pulleys, etc.; space is also to be provided for the dynamo-electric machines with the necessary wires and connections. As the steadiness and quality of the light are dependent entirely upon the steadiness of the power, care is taken to provide for this by the use of engines of approved make, with automatic cut-offs and other modern appliances for producing steady motion. The central station having been thus equipped, copper conducting wires are run from it on poles, on house tops, or underground, to the various points or places where light is needed.

The light is furnished and charged for in proportion to the amount used, and this is readily ascertained by noting the consumption of carbons in the lamps, which is sufficiently uniform for this purpose. When the engines in the lighting station are started the electric light machines are put in motion, and the electricity passes over the wires, and produces a light in each lamp in circuit. An automatic governor or regulator is provided for each electric machine, and this is so constructed and so connected to the machine that, without changing the speed of the machine, any number of lights from one up to the number capable of being produced by the machine may be burned without any disturbance or interference, either in the machine or in the lamps. By means of this simple and admirable contrivance any of the lamps in circuit may be turned off or turned on without increasing or diminishing the light in any of the other lamps in the circuit. From this description it will be evident that a lighting station of this character affords practically all the facilities provided in the use of gas, for the electric lamp may be turned on and off at the lamp itself as readily as if it were a gas burner. The lighting of interior spaces is in this way fully provided for in a practical manner.

In the matter of lighting streets and open spaces electric light possesses many advantages not possessed by any other illuminating agent. The electric lamps can be placed on top of lamp posts of moderate height, as in the lighting of Broadway, New York, each electric light providing for the illumination of a space two hundred to three hundred feet in diameter; or the lamps may be placed upon towers at a considerable elevation above the ground and above adjoining buildings, as is done in Wabash, Indiana, and Akron, Ohio; each light, or group of lights, providing for a general illumination over an area a mile or more in diameter. Either of these plans is perfectly practical and successful, and both have been thoroughly tested. For the lighting of cities and towns of moderate size the latter plan is the most economical, and will, no doubt, be very largely adopted. The town of Wabash, Indiana, was the first in the world to light its streets wholly in this way, and they find that four Brush lights, of 3,000 candle power each, placed on an iron flagstaff on the dome of their court house, at a height of about 130 feet above the ground, are sufficient for the general illumination of an area from one half to three quarters of a mile in every direction. Some of the streets are, of course, much better lit than others, although they are not nearer to the lights, because the light is not intercepted by intervening buildings. It is stated, however, that even in the streets where no direct light falls, and where the shadows are greatest, there is yet enough diffused light to permit of getting around without the use of other light. It is also stated that even at a distance of two miles from the lights there is a sort of general illumination produced which is of considerable value.

By placing a sufficient number of powerful electric lights upon towers high enough it is no doubt possible to produce an amount of light that would be practically as efficient as daylight for the lighting of all spaces within a reasonable distance of such towers. A sufficient amount of light could be thus provided to light the interior of buildings and dwellings sufficiently for ordinary purposes. This is the plan that has been proposed for the lighting of the Capitol and its surroundings at Washington.

It is proposed to place upon the dome of the Capitol, and upon six towers surrounding it, at a distance of 1,000 feet from it, no less than 450 electric lights, each of 6,000 candle power, or a total light of 2,700,000 candle power, equal to 200,000 four foot gas burners. The effect of such an enormous massing of light at such a distance above the ground and surrounding buildings would produce a surprising effect, and within a considerable area would, no doubt, be practically equal to daylight. If this plan is carried out the Brush light will be used. This subject will be brought to the attention of the next session of Congress.

The Brush Company have not yet taken up that branch of electric illumination known as incandescent lighting, because the voltaic arc system has so far proved vastly more economical than any possible incandescent system for the lighting of streets and large parks, buildings, manufactories, or halls. A single example will illustrate this fact. None of the advocates of incandescent lighting claim that their usual size of lights are any more powerful than an ordinary four or five foot gas burner; and wherever incandescent lights have been used at all practically, as at the Equitable Building in New York, each incandescent light has not certainly more than replaced one gas burner. The usual claim made by those who are interested in this system of lighting is that from five to seven lights of this size can be produced by the expenditure of one horse power. Others claim that four lights per horse power is as much as can be realized in practice. Assuming, however, that five can be produced from one horse power, it would appear that no less than 29 horse power would be required to supply 144 incandescent lights in the place of the 144 gas burners formerly used in the dining room of the Continental Hotel in Philadelphia. It is a fact, however, that this dining-room has for a long time been lit, much better than with gas, with two Brush arc lights, which, by actual dynamometer measurement, require *two horse power*—one for each light, or 15·48 horse power for the 16 lights used in the hotel. The Grand Pacific Hotel, in Chicago, replaces 571 gas burners with 16 Brush arc lights, requiring 16 horse power. If lit by the incandescent light no better than by gas, 114 horse power would be required, or, according to the figures of one prominent inventor in this line—7 lights per horse power—it would require about 82 horse power. This enormous difference in favor of the arc lights, where much light is required, will necessarily confine the small incandescent lights to small uses, where but few gas burners or lamps are now used. We are assured that when in the opinion of the Brush Company incandescent lights can be profitably and economically used they will take up that branch and be prepared to supply the market.

The officers of the Brush Electric Company (the home company) of Cleveland, Ohio, are as follows: General Mortimer D. Leggett, President (formerly Commissioner of Patents); George W. Stockly, Vice President, Treasurer, and Business Manager; F. K. Collins, Secretary; Nathan S. Possons, Superintendent; W. J. Possons, Assistant Superintendent. Agencies for the sale of apparatus and supplies have been established in all sections of the country. The most important of these are: the Brush Electric Light Company of New England, who control all territory east of 77° longitude, except Manhattan Island, of which company Mr. Lyman P. French, of Boston, is President, and Mr. Charles M. Rowley, of New York, Treasurer and General Manager. Mr. Rowley has been of the greatest assistance to the home company in the management of their Eastern business, of which he has certainly made a very great success. The Brush Electric Illuminating Company of New York controls the territory of Manhattan Island, and is pushing the introduction of the Brush light in this city vigorously. Their office is at 860 Broadway, which is also the main office of the N. E. Co., above mentioned. The N. E. Co. has branches at 5 Pemberton square, Boston; 430 Walnut street, Philadelphia; and in Baltimore and Washington. At Pittsburg the business for that vicinity is managed by Ridall & Ingold, 224 Liberty street. Chas. E. Stockly, at Rochester, is the agent for Western New York and Northwestern Pennsylvania. Other agencies are the Brush Electric Light Company, of Cincinnati; W. W. Leggett, 88 Griswold street, Detroit; M. C. Bullock, 84 to 90 Market street, Chicago (for the Northwest); the Brush Electric Association, 421 Olive street, St. Louis (for the Southwest); Colorado Electric Company, of Denver, Colorado; Salt Lake Power Light and Heating Company, of Salt Lake City; California Electric Light Company, of San Francisco, and others.

We publish in SUPPLEMENT 274, April 2, a monograph by Mr. Brush, giving a full scientific description of his apparatus and its mode of operation, illustrated with cuts and diagrams; also profusely illustrated articles from foreign journals on the same subject.

AGRICULTURAL INVENTIONS.

Certain improvements in that class of sulky plows having the plow beam supported by adjustable hangers arranged on a suitable frame extending back of the seat, and provided with vertical adjustment for raising and lowering the plow, have been patented by Messrs. Samuel M. Robertson and Augustus A. Hamilton, of Lynnville, Iowa.

Mr. Owen Davis, of Sullivan, Ind., has patented a separator for grain, etc., so constructed as to drive off the chaff and straw, separate the larger and smaller kernels of wheat, separate the split kernels of wheat, and the cockle and cheat from the grain, separate red clover seed, timothy seed, and red top seed from the grain and from each other, and to separate the larger kernels of oats from the smaller kernels.

Mr. Fred Aldred, of Glencoe, Ontario, Canada, has patented a swinging churn, having supporting springs, made in S shape, and attached to the ends of the churn above the central line; by this means the churn body is supported and allowed to vibrate.

An improved method of raising tobacco plants has been patented by Mr. James M. Dunkum, of New Canton, Va. The object of this invention is to protect the plants from the ravages of the tobacco fly or bug. The invention consists in protecting tobacco plants from the tobacco fly by surrounding the bed with logs, covering the bed with brush, and applying to the logs a mixture of whisky or alcohol, gum camphor, oil of peppermint, and linseed oil.

Mr. Lorenzo P. Teed, of Erie, Pa., has patented an improved ladder, designed especially for use in picking fruit from trees, but which may be used to advantage for any of the purposes for which ladders are required.

Mr. Philip H. Long, of Newark, N. J., has patented a separable button so constructed that the head and foot can be readily connected and disconnected, that the buttons will not turn in the button holes, and in which the fastening mechanism is connected with the foot, so that any kind of heads can be used.

Treatment of Carbuncle by Carbolic Acid.

In the Toledo *Medical and Surgical Journal*, December, 1880, Dr. J. T. Woods writes:

It is now about two and a half years since a patient presented with two carbuncles, one on the back of the head, the other below it, on the neck. They were of moderate size only, the upper one open in three places, while in the lowest the skin was unbroken.

Having considered the various known properties of the carbolic acid, I determined to use it vigorously instead of inserting it in meager quantity. I loaded my hypodermic syringe, and passing the point through the openings and into the sloughing mass in every direction, I completely saturated it with the pure acid and awaited results. In a minute the smarting disappeared and with it all pain and all sense of soreness.

By this result emboldened, I again charged my instrument, and thrusting it through the skin over the other carbuncle, in a variety of places, I soaked the whole carbunculous mass beneath the skin, enough of necessity escaping to fully bathe the borders, modify inflammation, and destroy any septic elements then developed. I waited, not without concern, and was delighted to learn in a few moments that all the pain and soreness was gone in this also. The skin over the mass became quickly white, hard, and dead, and in a few days detached, in the form of a slough, the interior mass also becoming rapidy loosened, only requiring the cutting of a few shreds to remove it, when the cavity was found to present a satisfactory appearance and rapidly filled up, leaving an exceedingly small cicatrice. The remarkable feature in this case was that after the complete saturation of the carbunculous mass no pain occurred, my patient going about his ordinary labor without discomfort. It is now one year since I treated a very painful case, the same method bringing about similar results, the party suffering no pain or even soreness after the lapse of one minute following the injection.

In making this suggestion, which, so far as I know, is new, I am conscious of the insufficiency of my cases, but I am so sure of its efficacy that I shall at once resort to it when case and occasion offer, and advise others to do so, at least until the value of the measure is determined.

In conclusion, I would advise the use of the pure acid only, and to complete saturation. Dilution would increase, if not create, danger of absorption of the acid, converting a very simple procedure into a condition of great danger, and insufficient quantity defeat the purpose for which it is used.

The Tides of Electricity.

Mr. Alex. Adams, one of the officers of the British Post Office Telegraph Department, has discovered the existence of electric tides in telegraph circuits. By long continued and careful observations he has determined distinct variations of strength in those earth currents, which are invariably present on all telegraphic wires, following the different diurnal positions of the moon with respect to the earth.

The Geological Survey.

Mr. Clarence King has resigned the directorship of the Geological Survey. The reasons given for the step are two: The administration of the office left him no time to pursue his investigations, and he believed that he could be of greater service to geology if unencumbered by executive duties and responsibilities. Major J. W. Powell is named as the probable successor of Mr. King.

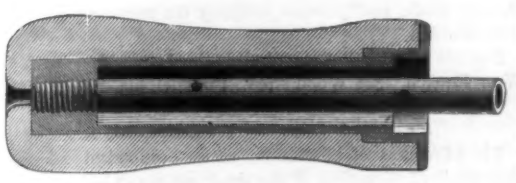
Collodion Films.

According to M. E. Gripon, if a layer of collodion, such as is used by photographers and surgeons, be poured upon a plate of very clean glass, it will be found, after the layer has dried, that an extremely thin and transparent film is formed, which, with a certain amount of care, can be separated from the glass, and may then be stretched upon a frame. This film, so placed, is seen to have some curious physical properties, which the author just named describes as follows: In the first place he finds that this delicate thin membrane reflects light exactly as glass does, and polarizes it both by reflection and by transmission of the rays of light through its substance.

M. Gripon has also found that films obtained in this manner may be procured as thin as 0·01 of a millimeter, and that when no thicker than this they transmit a very large proportion of radiant heat. Polarizing piles, he tells us, may be formed of these layers of collodion film, which are much more transparent than the piles of mica usually employed by physicists for this purpose, and necessary in studying the properties of heat; and although they are, of course, much more fragile, and require more careful handling than mica piles, they are also more easily replaced than the latter when destroyed.

NEW HANDLE FOR SOLDERING IRONS.

In ordinary soldering irons and like tools it is well known that the wood which surrounds the shank is liable to become loose on account of the shrinkage and expansion of the contiguous wood and metal, and to keep the handle tight in its place it has frequently to be driven on to the shank. This results in splitting the wood and the speedy destruction of the handle. Mr. A. A. Park, of Gill, Mass., has patented a handle which obviates this difficulty and renders the handle as durable as other parts of the tool. This handle is shown in longitudinal section in the annexed engraving. The shank of the iron is made of small gas pipe threaded at its



PARK'S HANDLE FOR SOLDERING IRONS.

free end and fitted to a perforated tube supported in the middle of the handle, which is hollow. This construction admits of a free circulation of air, which keeps the handle cool.

This handle may be fitted to an iron having an ordinary solid shank.

Comparative Health Statistics.

The cities of the United States which made weekly sanitary reports to the National Board of Health last year numbered sixty-eight. The Bulletin of the Board for February 19, contains in tabular form the aggregate results of reports so received, from which table it appears that Vallejo, California, was the healthiest place reported in 1880, and Norfolk, Va., the unhealthiest. The average life in Vallejo was 83·5 years, and only one person in 1,000 of population died of consumption, while in Norfolk the average life was only 27·9 years, and one person in 241 of population died of consumption. The aggregate population of the sixty-eight cities is 7,359,937, the average duration of life in them was 44·5 years, and there was one death from consumption for every 326 of population, and one death from acute disease of the lungs for every 429 of population In other words, of every 100 deaths 24·4 were from lung diseases, and of these 14 were from consumption and 10·4 from acute diseases of the lungs. Four of the best cities for health were Yonkers, N. Y., average life, 70 years; Omaha, Neb., average 68 years; Utica, N. Y., 67·5 years; Keokuk, Iowa, 67·1 years; and four of the worst cities were Jacksonville, Fla., 35 years; Vicksburg, Miss., 34·8 years; Charleston, S. C., 31·3 years; and Savannah, Ga., 30·6 years. In Boston the average life was 42·5 years, deaths by consumption one in 246, by acute lung disease one in 336 of population; in New York average life 37 years, death by consumption one in 254, and in acute lung disease one in 360; in Philadelphia, life 47·8 years, consumption one in 314, acute disease one in 844; in Cincinnati, life 47·8, consumption 346, acute disease 494; Louisville, life 47·6, consumption 300, acute disease 410; Indianapolis, life 47·8, consumption 447, acute disease 381; Chicago, life 48, consumption 593, acute disease 453; St. Paul, life 58·5, consumption 561, acute disease 715; San Francisco, life 51·8, consumption 295, acute disease 459; New Orleans, life 41·3, consumption 256, acute disease 584; St. Louis, life 52, consumption 447, acute disease 580. The difference between New York and Philadelphia in the general death rate and in that from consumption is great; in that from acute lung disease it is striking. Next to lung diseases diarrheal disorders cause the greater number of deaths. In every 100 deaths from all causes in the sixty-eight cities, 10 are from diarrheal disturbances, and there is one death from this source in every 436 inhabitants.

RECENT DECISIONS RELATING TO PATENTS.

United States Circuit Court.—District of Massachusetts.

SMITH *et al. vs.* MERRIAM *et al.*—PATENT PRESSER FOOT FOR SHOE SEWING MACHINES.

Lowell, J.:

1. Where the thing shown and described in the original patent and in the reissue is the same, but in the original has been claimed with all its features in combination, the patentee can in the reissue modify or divide his claim so as to embrace severally the distinct features of the thing invented.

2. The case of *The Giant Powder Company vs. The California Vigorit Powder Company et al.* (18 O. G., 1,839) considered and commented upon.

3. The most natural construction of the law relating to reissues (Rev. Stats., sec. 4,916) would perhaps be that, if a patent should be inoperative by reason of a defective specification or invalid for claiming too much, the defect might be supplied or the excessive claim be reduced by reissue.

4. But the courts have given a very different interpretation, much wider in most respects and narrower in only one. They do not permit a defective specification to be supplied excepting from the drawings or model; but they do permit the claim to be varied, provided the same invention is described in both patents.

5. The law is extremely liberal, perhaps too much so, and has been much abused; but if we change it suddenly we shall make a destruction of titles which it is impossible to contemplate without dismay.

6. As to the mere question of the necessity for a reissue, supposing the new patent itself to be unobjectionable, the decision of the Commissioner has always been held to be final, and this for an unanswerable reason that no patentee, however honest or careful, can be safe in obtaining a reissue if he is to be informed when he gets into court that the judge is unable to see why he should have surrendered his first patent. The slighter and more obviously unobjectionable the change the stronger will be the argument that there was no occasion to make it, so that honest and careful patentees will be the most likely to suffer.

7. A mistake by the Commissioner as to the necessity of issuing a new patent is not an excess of jurisdiction, but a mistake in a matter clearly within his jurisdiction, and the real question is whether it is one which the courts will correct by destroying a new patent after the old one has been surrendered.

8. Urgent reasons of justice require that, upon the mere question whether the paper called a reissue shall be given, the finding of the Commissioner should be, as it has hitherto always been held to be, conclusive.

9. If it be found that the claims of the original patent were valid, and that the reissue for the same invention states the claim or claims in a different way, the law is well settled that the change does not of itself vitiate the new patent, but that, on the contrary, the original claims are conclusively presumed to have been made as they were through inadvertence, accident, or mistake.

10. It has been brought out a little more decidedly by the later cases that the invention must be the same; but it has never been held in the Supreme Court or any circuit court that the Commissioner's decision is not final as to the propriety of a reissue as distinguished from its validity upon what may be called its merits, or that the claims may not be varied to express the real invention.

11. The claim is part of the specification, and if defective may be amended.

12. The Reissue No. 7,558, to Daniel A. Sutherland, March 13, 1877, for "improvement in presser-feet for sewing machines," was granted in order to enable the patentee to claim the actual operations of his tool in detail, which is a perfectly legitimate reason for a reissue until the law is changed by Congress or the Supreme Court.

Patent sustained.

MECHANICAL INVENTIONS.

Messrs. Francis W. Ashton, of Hyde, county of Chester, and William Mather, of Salford, county of Lancaster, England, have patented machinery for washing fabrics, which consists in certain combinations of machinery, whereby the fabrics in a distended state are continuously lifted out of and immersed in the water, soap liquor, or other liquid, while passing through the machine, so as to obtain a dashing action, which will effectually cleanse the piece while extended to its full width and without undue tension, thus obviating the necessity of washing pieces that are printed with color in the form of a rope, as at present.

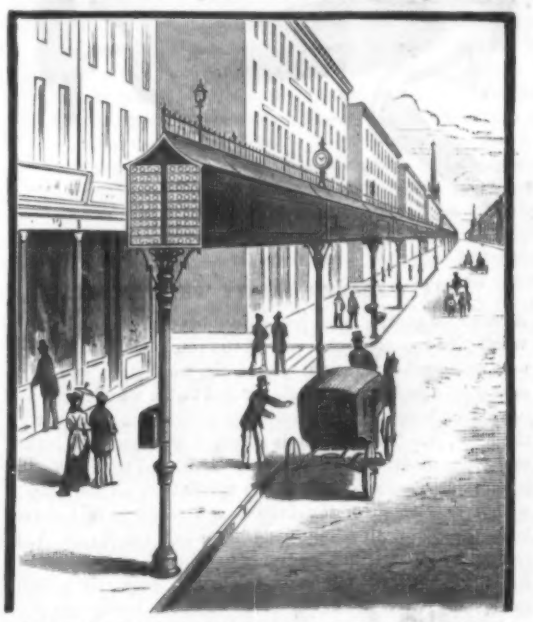
An improved glove-sewing machine has been patented by Mr. Claude M. Boland, of New York city. This invention relates to that class of machines for sewing gloves and furs in which are employed two parallel feed disks, a reciprocating needle, and an oscillating looper; and it consists in an arrangement of parts which cannot be clearly described without engravings.

EXPERIMENTAL RESEARCHES ON MAGNETIC COERCITIVE FORCE.—(D. Kulp.)—The author magnetizes iron and steel rods in spirals, which he opens before taking out the rods. On percussion, the permanent magnetism of the rods is partly increased, partly diminished, and partly inverted. As a series of induced currents arise in the rods on opening the spiral they have been exposed to magnetizing forces in alternating directions, whereby their behavior is explained. —*Wiedemann's Beiblätter.*

IMPROVEMENT IN TELEPHONE AND TELEGRAPH LINES.

We give an engraving of an elevated support for telephone and telegraph wires invented by Mr. T. G. Ellsworth, manager of the John St. office of the Metropolitan Telephone and Telegraph Company, New York city. Many useful and improved appliances are combined in this invention, making the whole structure an ornament rather than a blemish to the streets. In the larger cities telegraph wires are becoming objectionable to the public on account of the space they occupy, on account of the unsightliness of the poles and fixtures; and the great expense and trouble of constructing and maintaining the lines on house tops and in streets, is becoming a burden on the different companies.

The number of wires in many localities has become very large since the telephone has been so universally adopted. In many instances the breaking of a single wire has interrupted communication on twenty or thirty other wires, suggesting the necessity of some better means to carry the wires from point to point. The great value of telegraphic and telephonic communication lies in uninterrupted service, and any means that will insure this will undoubtedly prove valuable. The particular tube shown in the engraving has been selected from many desirable forms to illustrate this invention. Inside the tube, are arranged a number of shelves for supporting the cables, which are marked at suitable distances along the route in the covering. At each



ELLSWORTH'S TELEPHONE AND TELEGRAPH LINE SUPPORT.

street crossing is located an electric light, its support being a part of the structure. At proper distances are located letter boxes arranged for the attachment of a pneumatic tube for collecting the letters, or they may be collected in the usual way by carriers. Electric clocks are located at desired points. Police time detecters form a part of this system, each policeman to signal to station while on his beat. By this arrangement it may be known where the men are at stated times. Fire-alarm boxes are placed at suitable distances, and ambulance boxes are provided for calling ambulances. Drinking fountains are distributed at different points. These attachments constitute some of the uses which can be made of the structure. The columns being hollow admit of cables passing unseen underground to offices wherever desired, or special tubes can be arranged for conveyance above ground.

Birch for Cabinet Work.

The small value of birch wood for fuel, and its lack of toughness and strength, except in the smaller twigs, have led to its general neglect in the arts. Our more enterprising builders of railway cars, however, have discovered that its light weight, close grain, and rich finish make it admirably suited for certain applications where fine finish and bright effects are desired. The contrasts presented when white birch and light colored ash are relieved by the red of the cherry birch, are said to be peculiar but very pleasing.

Simple Mode of Toughening Glass.

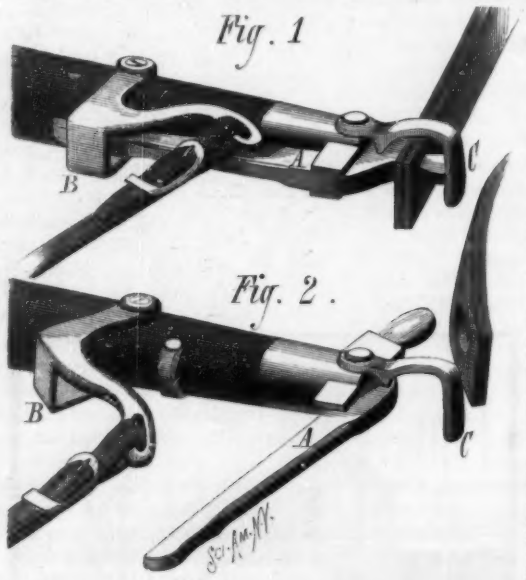
A Leipsic journal gives a method which it asserts will prevent lamp chimneys from cracking. The treatment will not only render lamp chimneys, tumblers, and like articles more durable, but may be applied with advantage to crockery, stoneware, porcelain, etc. The chimneys, tumblers, etc., are put into a pot filled with cold water, to which some common table salt has been added. The water is well boiled over a fire, and then allowed to cool slowly. When the articles are taken out and washed, they will be found to resist afterward any sudden changes of temperature.

THE DISAPPEARANCE OF A RIVER.—The labors of a number of miners have been successful in filling up the large chasm caused by the river Bradford breaking through the roof of a disused mine at Alport, in Derbyshire. The stream, however, still flows through the mass of rock and timber thrown into the opening, and finds its way to the Derwent underground. It is impossible to divert the stream by reason of the conformation of the ground. A large number of persons have visited the spot.

NEW SAFETY WHIFFLETREE.

The engraving shows a simple and effective device for instantly detaching horses from a vehicle. This invention was recently patented by Mr. B. J. Quattlebaum, and is controlled by Messrs. Brooker & Home, of Ridge Springs, S. C., who are general agents for the inventor in the United States. The invention will be comprehended by a glance at the engravings, in which Fig. 1 shows one end of a whiffletree with the trace attached, and Fig. 2 shows the device as it appears when letting the trace go.

The whiffletree is of ordinary construction and attached to the pole or shafts in the usual way. The end of the whiffletree is provided with a clip in which is pivoted the lever,



QUATTLEBAUM'S SAFETY WHIFFLETREE.

A, with its shorter arm projecting beyond the end of the whiffletree to receive the end of the trace, while the longer arm rests against the rear side of the whiffletree and is retained by a locking lever, B, pivoted to the whiffletree, and having its longer arm projecting in a direction parallel with the lever, A. To this arm is attached one end of a forked strap, the other end of which is connected with a similar lever on the opposite end of the whiffletree. This strap is within easy reach of the driver, and when pulled moves both levers, B, simultaneously allowing the levers, A, to escape, and permitting the traces to slip off, as indicated in Fig. 2. This operation is so simple and easy that a child can readily work the device even when the horses are pulling to their full extent. A spring guard, C, attached to the end of the whiffletree, serves to prevent the accidental unfastening of the traces. When the trace is to be put on or removed from the rounded end of the lever, A, the guard, C, is sprung out of the way. This device is simple and inexpensive, and there appears no reason why it may not outlast the whiffletrees. It is a useful and much-needed invention, and should find a ready application wherever horses are used.

IMPROVED HYDRAULIC RAM.

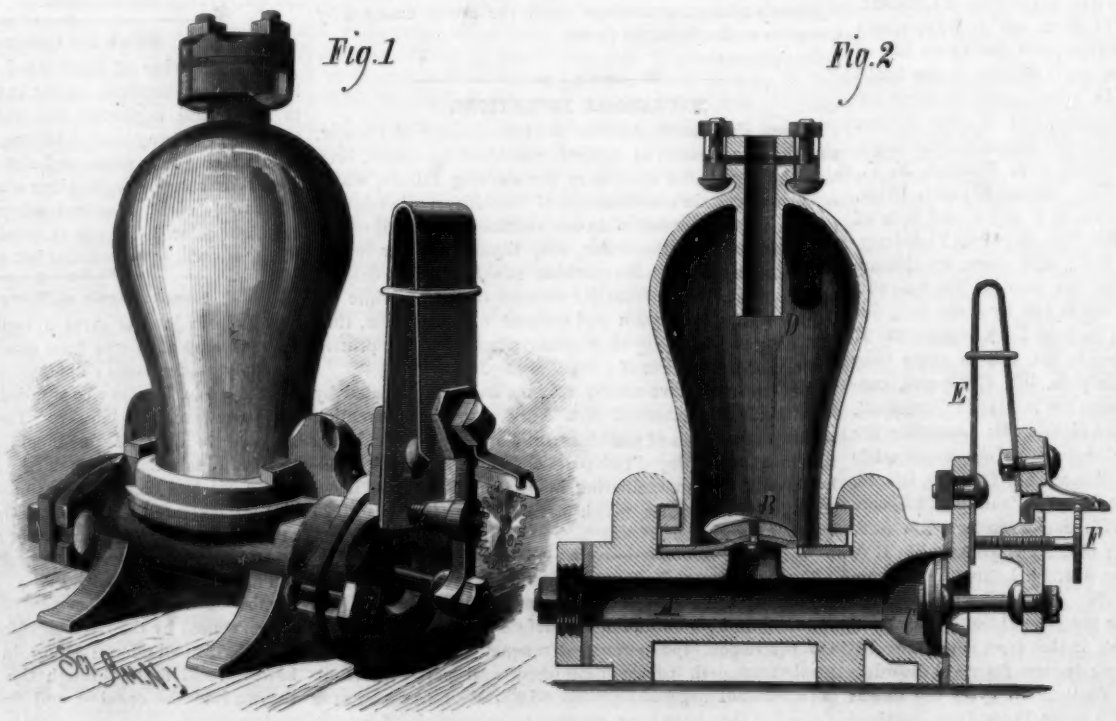
The hydraulic ram is one of the simplest and most desirable devices for raising water where a fall of a foot or more is available, providing its construction be such as to insure continuous and uniform action under equable conditions. A ram which seems to embody every essential feature without being unduly complicated is represented by the annexed engraving, in which Fig. 1 is a perspective view showing the exterior, and Fig. 2 is a vertical section showing the interior construction.

The base of the ram has a horizontal passage, A, with a discharge valve, B, at the top, and an overflow valve, C, at the end. Covering the discharge valve there is an air chamber, held in place by keys or wedges, and furnished with a discharge pipe at the top, which projects a short distance downward and serves the double purpose of a discharge for water and an escape for the surplus of air in the chamber. One of the greatest troubles with all rams, aside from this one, is the gradual increase of water in the air chamber until the chamber is filled and the ram stops. The ram shown in the engraving airs itself, and drives off with the water any surplus air when the quantity is more than sufficient to fill the space above the lower end of the tube, D.

The discharge valve, B, is attached to a flap formed on a disk of leather which also forms the packing of the lower end of the air chamber. The valve is concaved to receive the head of the rivet or bolt which secures it to the leather, and the leather touches the valve seat a short distance from the edge of the valve opening. By means of this construction the valve is always kept free from ridges, and whether or not it always strikes exactly in the same place it is always tight.

The overflow valve, C, is hung upon a casting attached to the lower end of the spring, E, and its stroke is regulated by the screw, F, which bears against the body of the ram. The screw, F, carries a toothed head which may be secured in any desired position by a stop or pawl. This construction admits of regulating the overflow valve to the $\frac{1}{64}$ part of an inch, and effectually prevents it from jarring out of adjustment. The valve can be regulated to make from 30 to 300 strokes per minute, and the ram may be adjusted so delicately as to raise water 10 feet on a 9 inch fall, or it may raise water 200 feet with less than 4 feet fall. For irrigating lands, supplying dairies, farms, barnyards, dwellings, factories, engines, railroad stations, villages, etc., this ram is invaluable, as its extreme simplicity enables it to be set up or repaired by any one likely to use it.

This improved form of hydraulic ram is the invention of Mr. H. F. Morrow, of Chester, Pa., who has a patent for it and an application pending.



MORROW'S HYDRAULIC RAM.

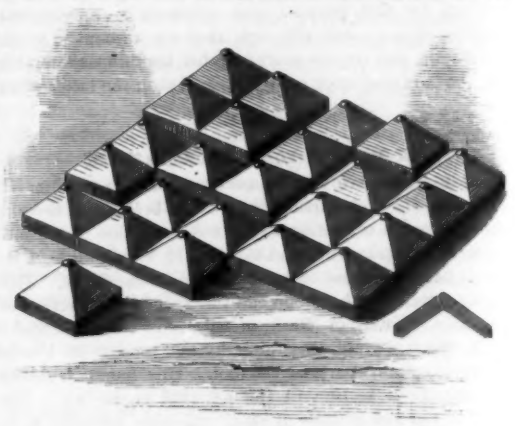
Mode of Purifying Oils.

Oils in their natural state are always more or less impure, and some of them so viscous as to be quite inapplicable to the lubrication of machinery, or to illuminating purposes, without previous purification. The impurities consist, for the most part, of albuminous, mucous, gelatinous, and coloring matters. A great part of the mucilaginous matters, and all bodies merely in a state of suspension, are deposited by repose for a short time; but, in order completely to clarify the oil, it is necessary to employ other means. The method most generally adopted is that suggested by Thenard. Sulphuric acid, for example, in the proportion of 1 to 2 per cent of the oil, acts as a purifying agent, precipitating the mucilage and parenchymatous matters: first, by its powerful dehydrating action, it removes the water by which the substances were held in solution in the oil, and afterward chars the mucous matters themselves, thus rendering them insoluble, or otherwise effecting their destruction. The oil itself is, to a small extent, acted upon. It becomes green or dark brown, and after some time yields a deposit of the same color, becoming itself bright and clear.

Thenard's purifying process, as improved by Cogan, is conducted as follows: The oil is heated to 212° Fah. by steam in a copper pan. When sufficiently hot, from 1 to 2 per cent of sulphuric acid is gradually poured in, with constant and violent agitation. As the action of the acid depends more or less upon the amount of contact between the two liquids as well as upon the degree of heat, Cogan's improvement consists in blowing steam through the mixture. In five or ten minutes the action will be complete, and after twenty-four hours' repose, the oil will be almost entirely freed from acid, and the black feculent dregs will subside, leaving the supernatant oil quite clear and greatly improved in color. For one hundred gallons, ten pounds of sulphuric acid are required, diluted with an equal bulk of water. After standing for twelve hours, the black watery acid liquor is withdrawn, by opening a stop cock at the bottom of the pan. The clear and limpid oil is then drawn off by opening a tap in the side, and what remains below this tap is turbid, and this, being let out into a reservoir, is either clarified by subsidence, or mixed with the next portion of raw oil.

NOVEL FIRE KINDLER.

The engraving shows a recently patented fire kindler which dispenses with matches, and is always ready and reliable. The kindler is moulded from inflammable material in the form of hollow pyramids, a number of which are produced in a sheet, as indicated in the illustration. The apices of the pyramids are tipped with a striking surface of material something like that applied to the ends of safety matches, which can be ignited only by striking it against a prepared surface. This admits of packing and shipping the kindlers with perfect safety. The peculiar form of the sheet admits of forming a very close package, and it facilitates breaking off one or more of the pyramids as may be required. The material of the kindler is easily ignited, and burns for a long time, giving off no unpleasant odors. It is



IMPROVED FIRE KINDLER.

cheaply made, and answers perfectly the purpose for which it is intended.

Further information may be obtained by addressing Mr. Wm. Rausch, 1828 Wood street, Philadelphia, Pa.

Proposed Crematory in Brooklyn.

The advocates of cremation, as an economical and sanitary mode of disposing of the dead, appear to be increasing in number and confidence. It is now proposed to establish a crematory in Brooklyn, a gentleman having tendered a plat of land there for the purpose. Steps have been taken to organize a society for the construction and operation of the crematory, with an associated society for collecting, collating, and publishing information in relation to cremation and its advantages. It is expected that the expense of cremation may ultimately be reduced as low as five dollars.

Compressed Air Locomotive.

A preliminary trial to test the practicability of employing compressed air instead of steam as the motive power for an underground railway lately took place on the Metropolitan line, London. The engine employed was one of Beaumont's compressed air locomotives, and was originally made for a tramway. It was not large enough to draw a complete train, the wheels being only thirty inches in diameter. The inventor, Colonel Beaumont, R.E., was present, together with Mr. Tomlinson, chief engineer of the line; Colonel Frank Bolton; Major Ardagh, of the War Office, and several other gentlemen. A start was made from the Chapel street works of the railway company, near the Edgware road station. The engine ran to Baker street, where it was shunted on to the St. John's Wood line to pick up a carriage, which most of the party entered in order to continue the journey. The engine then ran from Baker street to Moorgate street. On the return journey, after a halt at King's Cross, the engine ran without a stop to Edgware road, the distance between the two stations—which is for the greater part an ascent of 1 in 100—being performed in eight minutes, or less than the average time taken by the ordinary trains The total distance run, including the shunting, was about eleven miles, and the weight moved, including the engine itself, was about 20 tons.

The engine commenced with an initial pressure of 1000 lb. on the square inch, and when the run was finished the gauge showed a remaining pressure of 300 lb. in the cylinders. The engine was perfectly under control throughout the trial, and was started and stopped with the greatest ease. Further experimental trials will be made on the Metropolitan line, but for the present the result is considered highly satisfactory.

Hudson's Bay as a Possible Outlet for the Northwest.

During the past summer the engineers of the Nelson River Railway Company have surveyed a railway route between Norway House at the outlet of Lake Winnipeg and Fort Churchill on the Hudson's Bay. The distance between these places is about three hundred and fifty miles. The surveyed route first follows the course of the Nelson River for a distance of nearly one hundred miles over a level country. The next part of the road is over a broken rocky country, where the Nelson River has a descent of nearly seven hundred feet to the lower plateau, where the country again becomes level, and continues so to Hudson's Bay. Upon entering this rocky range the surveyed route leaves the Nelson River, taking a more northerly course toward the valley of the Churchill River, which is reached at its entrance on the lower plateau, and continues to follow the course of the river to its outlet in Hudson's Bay. The estimated cost for building the road-bed is ten thousand dollars a mile on the plateau and seventeen thousand dollars a mile through the rocky portion of the route, or an average of twelve thousand dollars per mile along the whole route.

It is claimed that by this route it will be possible to transport grain from the Saskatchewan Valley to Liverpool for less than it will cost to carry it to Montreal by the proposed railway north of Lake Superior.

Professor Bell, of the Canadian Geological Survey, who sailed from Fort York, Hudson's Bay, and passed through Hudson's Straits in the latter part of last September, says that sailing vessels have sometimes considerable difficulty and delay in getting through, but steamships can make the voyage at any time between the first of May and November, as the straits are nearly one hundred miles wide in the narrowest part, and the channel is not obstructed by ice.

A Gigantic Electrical Battery.

An immense galvanic battery has been constructed for use in the lectures at the Royal Institution, London. It consists of 14,400 cells of chloride of silver and zinc elements. Each cell is composed of a glass tube about the size of a large test tube, stoppered with a paraffin wax stopper, through which the zinc rod and chloride of silver are inserted, a small hole being left to pour in the solution, which consists of a weak solution of chloride of ammonium (sal-ammoniac), the hole being fitted with a small paraffin stopper to make it air-tight. The tubes are mounted in trays, each containing 120 cells; eighteen trays are fitted in each cabinet. The battery, which is in the basement of the building, was begun in June, 1879, and finished in August, 1880. The charging of the battery occupied three persons a fortnight. A lightning flash a mile long could be produced by 243 such batteries, and yet Faraday has proved that the necessary amounts of electricity to produce a powerful flash of lightning would result from the decomposition of a single grain of water.

RUSSIAN BEER FLAGON.

The annexed engraving represents an example of Russian artistic metal-work. It is a massive silver flagon wrought in high relief, in a spirited design embodying an episode in

SILVER RUSSIAN BEER FLAGON.

the life of Peter the Great. With the exception of the waist of the vessel and knob of the cover the flagon is quite plain, but the relief portions are done in a style characteristic of Russian art.

SCALY-FINNED FISHES.

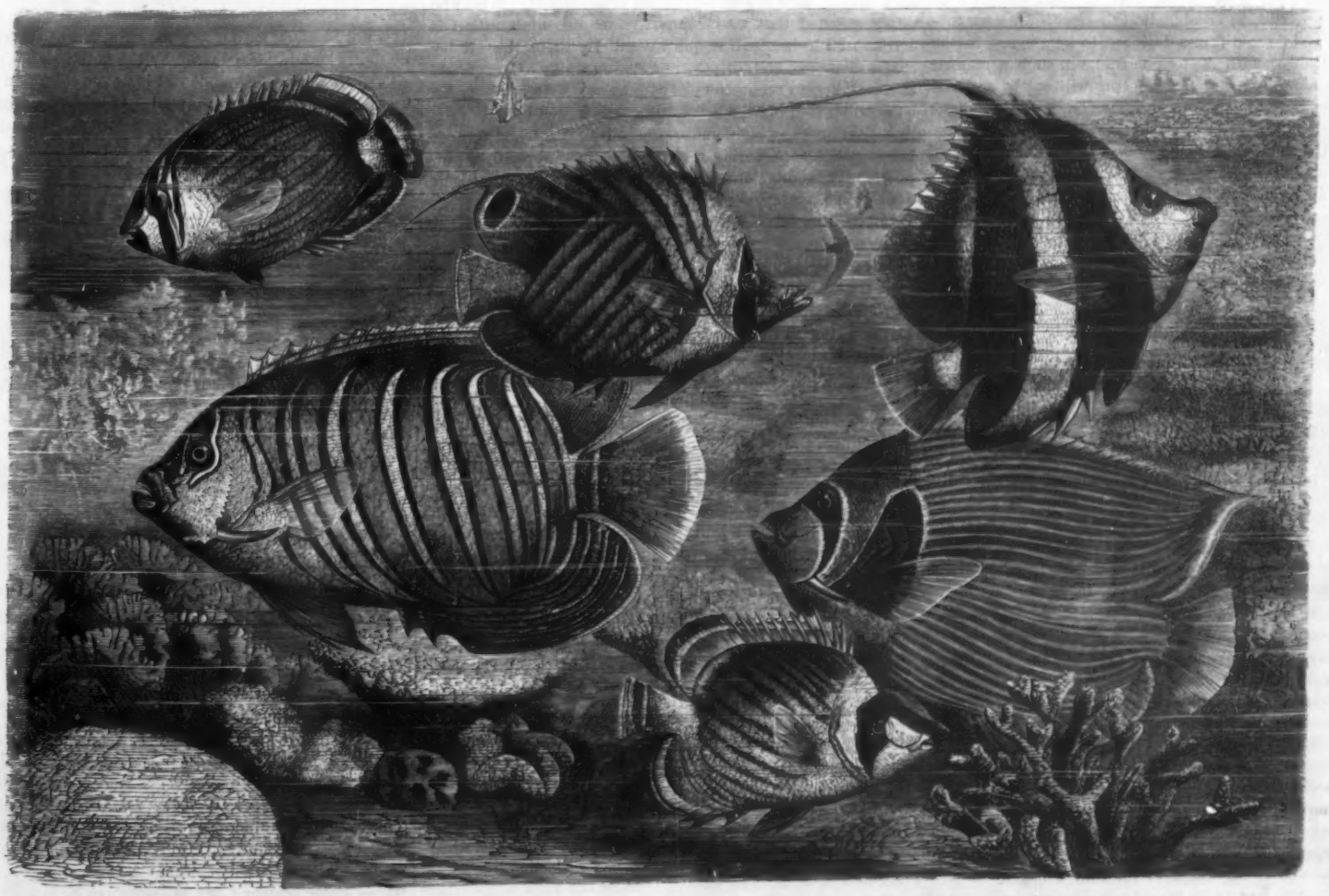
Our engraving represents members of a large family of fishes called by Dr. Günther *Squamipinnes* or scaly-finned fishes, because "the vertical fins are more or less densely covered with small scales;" but the spinous portions are not always scaly. These fishes are mostly carnivorous, and are inhabitants of the tropical seas and rivers. They are remarkable for their peculiar shape and their strange coloring. Their bodies are thin and very deep in proportion to their length, and their mouths are usually small.

The first group of this family have small mouths furnished with several rows of tiny, slender, and bristle-like teeth, which give them their scientific name *Chætodontina*, a term composed of two Greek words, the former signifying hair, and the latter a tooth. The colors of this group are brilliant and generally arranged in stripes or spots. Black and yellow are the prevailing colors, but blue and green are found in some species.

Fig. 1 in our engraving represents a fish which is found in the Indian Ocean and the western part of the Pacific Ocean, and is called by the Arabian fishermen of the Red Sea the flag fish (*Chætodon setifer*), on account of the considerable lengthening of the fourteenth ray of the dorsal fin. Dark bands run in different directions upon the whitish ground of the body. A black band edged with white extends from the neck through the eye to the throat; it is widened on the under side. Five or six blackish bands run obliquely from the front upward toward the dorsal fin, and from these lines eight or ten bands issue nearly at right angles, take a slight sweep downward, and then converge toward the tail. The region over the eye is also ornamented with four orange-yellow diagonal lines. The back part of the dorsal fin is lemon color, and has a black spot surrounded with an edge of white; above this the fin is a fiery red edged with black. The caudal fin is lemon yellow, ornamented on the back side with a crescent-shaped pale yellow and white-edged girdle, then with a cylindrical dark brown, black-edged girdle. The anal fin is orange color edged with black and seamed with white. The pectoral and abdominal fins are reddish-white. The dorsal fin has thirteen spinous and twenty-five soft rays, the anal fin three spinous and twenty soft rays; the pectoral fin has sixteen, the abdominal fin six, and the caudal fin seventeen rays. The length of the fish is about eight inches.

The coral fish (*Chætodon fasciatus*), Fig. 2, is about six and a half inches long. The main color of the head is white, with a broad black band extending from the crown of the head to the "præ-operculum," or front gill cover. The body is a bright yellow, ornamented with from nine to twelve brownish-black bands running obliquely from the front upward and back, reaching to the yellow fins. The lips are rosy red. The soft dorsal and anal fins have a black border. The caudal fin has near the end a lentiform black diagonal marking and a whitish edge. The dorsal fin has twelve hard and twenty-five soft rays, and the anal fin three hard and nineteen soft rays. This fish inhabits the waters extending from the Red Sea to China.

A third species of this group is the cliff fish (*Chætodon villatus*), Fig. 3. It is about four and a quarter inches long. The ground color of the body is lemon yellow, and has about thirteen longitudinal stripes. The head is ornamented with a broad black curved eye band, with a narrower band behind it running in the same direction. The brow has three or four diagonal lines, which, with the bands and the surroundings of the mouth, are black. The soft part of the yellow dorsal fin has a black edged band and an orange colored border. The anal fin has a bright yellow stripe extending the whole length with an orange colored border, and the black caudal fin has a broad rosy-red border. The dor-



1. FLAG FISH.—2. CORAL FISH.—3. CLIFF FISH.—4. CHARIOTEER.—5. DUKE FISH.—6. EMPEROR FISH.

sal fin has thirteen hard and twenty-one soft rays, and the anal fin has three hard and nineteen soft rays. This beautiful fish is found in the waters between Eastern Africa and the Society Islands.

Fig. 4 represents a remarkable fish which, on account of the peculiarly elongated dorsal spine, has received the name of long-spined chætodon or charioteer. It also exhibits well the scale covered fins. Both of the scientific names *Heniochus monoceros* are of Greek origin, the former signifying a charioteer—the long slender spine representing the whip; and the latter signifies "single horned," in allusion to the same peculiarity. The fourth dorsal spine is enormously elongated and whip-like, its use not being as yet ascertained. The prevailing color is grayish-yellow, which passes upon the breast and throat into a silvery white; the head is partially or wholly black, the side of the snout light. Two very broad black bands are drawn across the body touching the fins. The first extends from the back to the abdomen; the second is almost parallel with the first, and runs from the fifth to the eighth spine of the dorsal fin downward to the extreme end of the anal fin. The fins are lemon color where they are not touched with the bands. This fish inhabits the whole of the Indian Ocean.

Nearly forty species of the genus to which the duke fish (*Holocanthus diacanthus*), Fig. 5, belongs are now known. They all possess some remarkable peculiarity of coloring, and the front gill cover is armed with a strong sharp-pointed thorny spine. The ground color of the body is lemon yellow. There are eight or nine pale blue bands broadly edged with black extending diagonally across the body. The back of the head is black, and beautifully marked with blue longitudinal and diagonal lines. A blue stripe surrounds the eye, another runs down to the edge of the front gill cover. The pectoral, abdominal, and caudal fins are yellow. The soft part of the dark brown dorsal fin is striped with black and blue at the edge; the remainder is spotted with dark blue. The brown anal fin is ornamented with six or seven curved bright brown bands. Fourteen hard and nineteen soft rays support the dorsal fin; three hard and nineteen soft rays, the anal fin.

The emperor fish (*Holocanthus imperator*), Fig. 6, is still more beautiful. The smutty sulphur-yellow head is adorned with a brownish black brow and eye band, which is edged with bright blue. The region over the pectoral fins has a large black spot bordered with yellow which stands out distinctly from the violet blue color of the body. The body is ornamented with a large number of curved yellow stripes extending throughout its entire length. The abdomen and breast are a greenish brown, the fins bluish, their rays brighter or darker orange color merging into black. The brown anal fin is decorated with blue curved longitudinal lines. This fish has also the thorny spine on the front gill cover. It is an inhabitant of the Indian Ocean.—*Brehm's Animal Life.*

MISCELLANEOUS INVENTIONS.

An improved buckle has been patented by Mr. N. L. Anderson, of Sioux Falls, Dakota Ter. The invention consists of a curved, looped, and barred frame, through which the trace is designed to pass, having a vertical stud projecting from the upper edge of the rear bar and designed to enter the trace, and, in combination therewith, of a tongueless barred and curved frame designed to be secured in the hame tug, locking with the tongue frame in such a manner that a strain upon either trace or tug will apply a corresponding pressure to compress the trace between the tongue bar of the one frame and the cross bar of the other frame.

Messrs. Cristobal Benavides and Joshua P. Arthur, of Laredo, Texas, have patented an improved sheep shears, so constructed that the blades are separable from the handle.

Mr. Minard M. Smith, of New York city, has patented a series of coated alkali balls attached together and traversed by a common wire passing through the entire series.

An improved shoulder pad has been patented by Mr. Isaac N. Stern, of New York city. This invention consists in a hollow segment-shaped pad, made of some air-tight material, such as rubber or oiled silk, which pad is inflated and placed between the cloth of the coat and its lining at the joint of the sleeve and shoulder.

An improved stop for oil can spouts, which allows for inlet of air when oil is poured from the can, has been patented by Messrs. Winfield S. Ricker and Robert H. M. Barker, of Cambridgeport, Mass. The invention consists in a spring finger lever provided with disks covering the neck and spout of the can, and fitted so that they may be simultaneously opened by pressing the lever, to permit of the oil being poured out and to admit air into the can, the lever being also adapted to be moved aside to open the neck for filling.

Mr. John D. Brooks, of Jersey City, N. J., has patented a surface condenser, more particularly for marine engines, which provides large condensing surface in a small space. It is constructed with a series of narrow steam condensing spaces of annular corrugated form in cross section with intervening cold water spaces of similar form.

Mr. George B. Stetson, of New Bedford, Mass., has patented a twist drill grinding machine. The invention consists of a sliding head adjustable on a suitable standard, so as to be moved toward or from the grinding wheel, and supporting a horizontally swinging bed, on which is mounted a chuck or jaws for holding the drills to be ground, and supporting also a sliding plate or fulcrum, a system of levers connecting the same with the chuck or jaws, whereby the latter may be vertically adjusted. And it consists, further, of a stop and a drill guide attached to the chuck, and of novel arrangements of grinding wheels and other parts of the machine.

Mr. Samuel H. Bakewell, of Lansing, Iowa, has patented a pump which reduces the comparative pressure of the water on the piston, and the power required to work the pump, and which throws water both during the ascent and descent of the piston.

Mr. William D. Peebles, of Breckenridge, Texas, has patented a balanced piston engine, which may be operated by water, steam, air, or other gas, and may be run at high speed.

Mr. Edward A. Eustice, of Greenvale, Ill., has patented a sulky plow so constructed that it can turn a square corner and can be readily adjusted to deep or shallow furrows. As the team starts forward in a new direction the plow is turned at right angles or at the angle which the new direction makes with the former direction, and at once begins to cut a furrow, no ground being left unplowed and no wide space being required for turning the machine. The machine is turned by the draught applied to the draw-rod (each horse drawing his own share) instead of by side pressure upon the tongue.

Mr. Edward A. Fisher, of Worcester, Mass., has patented a castanet which consists of two pieces or strips of wood, the longer of which has an aperture made through it from side to side near its lower end, and an insulated plate secured over the aperture, while the shorter piece has a ball, preferably of wood, attached by a rigid shank to its lower end, the castanets being operated by holding them between the fingers of one hand and striking the ball against the metal plate. The tone produced is musical, and by using a number of the instruments on each hand a tune can be played.

Mr. Rector R. Wilson, of Stewart, Ohio, has patented a locomotive which provides a substitute for springs supporting a locomotive engine on driving wheels and trucks. The engine is free to swing laterally as well as longitudinally, and rides more easily and with less wear upon the rails. The supporting frame is itself supported upon standards resting upon the boxes of the driving wheels.

Mr. Henry S. Rogers, of Auburn, N. Y., has patented a boot and shoe shave and bead cutter. It is a combination tool for trimming edges of boot and shoe soles, cutting beads, and cutting strips on the bottom of the soles. A handle carries an adjustable slide having an adjustable stripe-cutting knife attached and also carrying a combined shave and bead cutting knife.

Oil, Tallow, and Tow.

Considering that the materials referred to in the heading of this article are in such general use in coal and other mines, a few remarks upon them will probably be read with interest, especially if we point out some simple ways in which their qualities may be tested.

Olive oil used for engine lubricating should not be contaminated by earthy or other impurities, nor should it contain any acids, which act detrimentally on machine journals, springs, and the sliding surfaces of the steam distributing organs. The presence of acid in oils may be detected by immersing litmus paper into the oil. The paper will be reddened in color if acid be present in the liquid. It may be safely asserted that every impurity or oil adulteration is detrimental to lubricating purposes. By them the oil becomes thickened and soils the lubricating wicks. Care should also be taken to retain the oils as pure as possible, which can be done by keeping the lubricating vessels well closed. Egg like substances, which cause the oil to turn bad and to become sticky, rendering it quite unfit for lubricating purposes, may be more or less distinctly detected by their turbid appearance.

Lubricating oils should not be too thick, in order that they may be easily absorbed and able to run between the bearing-brasses; nor should oil, on the contrary, be too thin, so that it may remain for some time between the bearing surfaces of rotating shafts, etc., without losing its lubricating property. If the oil runs too easily, a waste must ensue by a too rapid consumption.

Perhaps the simplest way to test the consistency of various oils would be by the employment of a flat iron bar, 4 or 6 feet long, and channeled with equal grooves. This should be inclined, and an equal number of drops of the various oils allowed to fall on the top of the bar, care being taken to observe which quality travels the greatest distance in certain times. This will at once indicate which of the oils is the thinnest or the most liquid. The narrower the streak which the oil leaves behind it in traveling down the bar the greater is its consistency. For lubricating purposes, that quality is the best which has traveled furthest after the lapse of several days, provided, of course, that the oils have been poured in precisely equal quantities on to the bar. Oil which has dropped, or which has been taken out of the lubricators, should not be again used for oiling journals and brasses; it is far better to collect it in separate vessels, and after letting it stand, to use it up for the guide bars.

The most common and the most pernicious adulteration—which may be detected both by smell and taste—is the oil obtained from the cotton seed. This substitute is much thicker, and deteriorates the quality of olive oil. It speedily turns the latter bad, and so renders it worse than useless.

Engine parts which come in contact with the live steam are best lubricated by tallow, because the high temperature of the steam easily evaporates oil. It is not economical to pour melted tallow into the cylinders or valve boxes; the steam mostly carries this away into the condenser or into the open air. Consequently, tallow is best to be used in the lubricators adapted to receive it, as then the whole of the rubbing surfaces are covered with a thin film of tallow, because of its falling drop by drop into the main steam pipe, whence the live steam takes it into the valve box and passes it on to the cylinder, where it then falls on to the rubbing surfaces.

The stuffing glands of both cylinder and valve chest should be amply lubricated with tallow. It is unquestionable that much annual expense might be saved to steam users were they to take more active interest in watching and checking the wasteful modes in which their engines are lubricated, and in enforcing upon their engine drivers greater economy in this respect. Thus, the use of large oil cans with small lubricators, the pouring of oil on to gliding surfaces, which usually gives more oil to unexposed surfaces than to the bearings, and the overfilling of lubricators, are some of the most prevalent of wasteful habits practiced in engine houses.

As with oil, so tallow also should be as pure as possible, and be free from all foreign matters, which are to be detected in a turbid appearance. If the use of impure tallow is at times rendered compulsory, it should be melted down before use. After scumming the surface, the pure tallow may be poured off, but the bottom sediment should be rejected. As the bottom of tallow casks are generally dirty, it is also advisable to go through the same melting-down operations when the bottoms are nearly reached. Tallow contains more or less of fatty cells, which, though not injuring the appearance, deteriorate the quality of the tallow very much for lubricating purposes. To test tallow in this respect, all that is required is to take a sample and to boil it well with water. The fat collects together on the water surface, when it is allowed to go cold. If the tallow is free from these fatty cells, then its under surface will be comparatively even; but if otherwise these cells will show themselves there not unlike roots. According to the greater or less abundance of these roots, the purity or impurity of the tallow may be judged. As a proof against the tallow being rancid, the water in which it is boiled should not act as an acid on litmus paper.

Tow which is intended for engine purposes should be clean, free of roots, sand, etc. Its fiber should be solid and strong, or it is otherwise rotten and not wall adapted to this purpose. Tow which is rough to the touch and which contains much unbroken fiber, is of secondary quality. Prime qualities are advantageously chosen, and in this state tow presents long, delicate, and soft fibers of white color. It is true the cost of purchase is in this case enhanced, but the ensuing smaller consumption more than amply covers the extra expense of prime cost. Cotton-waste may be equally advantageously used.

To utilize cotton-waste or tow over again, *i. e.*, to clean it, water-glass may be diluted with three parts of water, and the tow or waste immersed and worked round with a stick. After half an hour's soaking the liquid may be let off, and hot water poured on to the waste, which should be then well rinsed. If the original soft touch is required to be regained, the waste or tow may be rinsed a second time in lukewarm water, when it will be found, after drying, to be equal to new. Particular care should be taken when using the water-glass not to allow it to touch the skin, hence the stirring of the liquid should not be done by the bare hand.

Tow which has been once wet is not so efficacious, because it does not absorb the oil so well. If it has by mistake been steamed, it should be aired, to prevent it from moulding, etc. If the tow is not clean it should be carefully beaten in small parcels to cause the impurities to fall out. Oily tow which is merely kept for lighting up fires should not be allowed to be thrown anywhere. It should be kept carefully in a place by itself, and caution observed to prevent spontaneous combustion.—*Colliery Guardian.*

Gold and Silver Statistics.

The Director of the Mint has submitted to the Secretary of the Treasury a report upon the production of precious metals in the United States for the fiscal year ending June 30, 1880, which shows the following amounts by States and Territories:

	Gold.	Silver.	Total.
Alaska	$6,000	—	$6,000
Arizona	400,000	$2,000,000	2,400,000
California	17,500,000	1,100,000	18,600,000
Colorado	3,200,000	17,000,000	20,200,000
Dakota	3,600,000	70,000	3,670,000
Georgia	120,000	—	120,000
Idaho	1,980,000	455,000	2,430,000
Montana	2,400,000	2,500,000	4,900,000
Nevada	4,800,000	10,900,000	15,700,000
New Mexico	130,000	425,000	555,000
North Carolina	95,000	—	95,000
Oregon	1,000,000	15,000	1,105,000
South Carolina	15,000	—	15,000
Utah	210,000	4,740,000	4,950,000
Virginia	10,000	—	10,000
Washington	410,000	—	410,000
Wyoming	20,000	—	20,000
Other sources	14,000	—	14,000

Daniel Atley Webster.

Daniel Atley Webster, for forty years connected with the Croton Aqueduct Department, died recently in this city. It is said that there are not more than a thousand dwellings in this city in which Mr. Webster did not personally superintend the introduction of Croton water. The method of tapping street mains for the introduction of house pipes, invented and patented by him, is in use wherever there is a public water system. Mr. Webster's name is associated with many other important inventions.

Silk Growing in America.

The rapid growth of the silk manufacturing interest in this country was recently made evident in these columns by a review of the census statistics gathered by Mr. Wycoff. Commenting upon the same facts, and the superior quality of American manufactured silk, the Philadelphia *Public Ledger* gives a large amount of interesting information touching the production of raw silk and its possibilities in the United States. The *Ledger* says:

"It is as easy to raise cocoons as sheep—easier. The intermediate stages between the cocoon and the factory have yet to be undertaken, but cocoons and eggs are both raised in this State, in North Carolina, and in Missouri, for sale and export. The shearing of the cocoons, or the filature, is the step that has to be taken on an extended scale. The great cocoon market for the world is Marseilles. The silk filatures are grouped in the departments around Lyons, and the French raised cocoons are consumed in the immediate neighborhood in which they are raised; but the foreign cocoons, coming from all countries, are distributed from Marseilles, and there they are purchased to the best advantage. Consul Peixotto points out, in a private letter to the American Minister at Paris, in answer to some inquiries made through Mr. Noyes by the Philadelphia silk school, that American-grown cocoons can be sold at Marseilles as readily as any others, as soon as the quality, and especially the uniformity, of the cocoons become known in the markets. By the efforts of this school American-grown cocoons will doubtless soon be placed on sale in this important depot to direct the attention of American silk raisers to this point. There have been already given in the *Ledger* such details of silk growing under the management of this school as will satisfy any one that all that is needed is such a point to which the numerous little harvests all over the country can be gathered and forwarded. Here is one experience from Gwynedd, Pa., representing six weeks' care of one crop. There were raised in one farmhouse, just as an experiment and to see how it would work, thirty pounds of cocoons and fifteen ounces of eggs. The cocoons are worth at a market two dollars a pound; the eggs, from three to four dollars an ounce. From a North Carolina farmer comes a letter on a larger scale. He has put up one hundred and fifty racks this year, four feet long by three wide, and each rack is to accommodate two thousand worms. He expects to raise this summer one thousand barrels of cocoons (North Carolina cocoons, pure white, took a premium at the Centennial); but this grower raises also from the French eggs the large flesh-colored cocoons, of which about one hundred and ninety weigh a pound, and from the Japanese eggs also a fine cocoon.

"But why, asks the protective and otherwise thoughtful reader, need the cocoons be sent abroad to be sold, and this golden fleece sheared by French hands? Why can they not be kept at home, seeing that the silk manufacturer can, or at least could, take all that can be raised for years to come? That is the point which is now occupying the minds of *sericulturists*—seriously occupying them. Cocoons and eggs and all that, they know. They know that the mulberry will grow wherever the apple tree does, and that the osage orange does about as well as the mulberry. They know that the season begins on the eleventh of May and lasts six weeks, and that it is possible, by skillfully retarding some of the eggs, to make two seasons in the year. What they have not yet reached is the perfection of reeling, although they are experimenting upon it. The hand reeling of Italy and France is an old story. Silk has been reeled by hand here, and is still, and if the farmer's daughter puts her reeling at the same price as her knitting or crochet, to fill up the unemployed time, and not for an occupation to live by, hand reeling would pay to that extent. For an extended business the great filatures are needed, where American cocoons can be reeled at home by machinery, the only thing that can come into competition with the cheap day labor of the Italians, French, and Japanese hand reelers. A young American engineer is at this time in France, experimenting on the reeling of silk by electricity, which is the motive power destined to lighten labor as well as streets. This is the one missing link that is needed to complete the chain between Horstmann's fringes and ribbons and the New Jersey silk dress goods and handkerchiefs, the Connecticut sewing silks, etc., and the cocoon racks in American farmhouses. The Philadelphia school, that has done so much in gathering up these threads of detail, and in sending out its cocoons and instruction over the country, is a real credit to the city and the State."

American Goods.

The *American Register* boasts, and not without reason, adds *Land and Water*, of the slow but sure manner in which American goods are forcing their way into and successfully competing in all foreign markets with European manufactures. "Our cotton goods, both heavy and fine, and our spool thread, are rapidly taking the place of English. Our printing and wrapping paper is finding a ready sale in the East and West Indies, while even bank note and bond paper is in demand in Italy, Austria, and Spain. American cutlery is sold in Birmingham, our locks are supplanting those of English make in English houses. American jewelry is sold in Paris, and if we are not sending coals to Newcastle, London is talking of supplying her grates and furnaces with anthracite from Pennsylvania." English manufacturers must stir up and put their shoulders to the wheel, or they will be nowhere in the race for wealth.

Why some Confectioners do not Make Money.

The following, by C. F. Gunther, in the *Confectioners' Journal*, is *apropos* to many people in other trades:

They are lazy.
They neglect details.
They overlook the small things.
They have no eye to business.
They hope for fortune to drop in their lap.
They are not careful in weighing.
They let their clerks eat and give them away.
They let their help waste and destroy.
They let their fires burn at will.
They are slovenly in their shops.
They let their shops get filthy and dirty.
They fail to clean their jars and cases.
They make no changes in goods.
They fail to furnish good tools.
They try how cheap they can do everything.
They make no window changes.
They fail to advertise.
They try not to excel or improve.
They think cheapness recommends articles.
They have too much outside business.
They talk politics too much.
They philosophize on everything but *their* business.
They fail to invent or have new ideas.
They employ too cheap help.
They fail to show what they have.
They try to sell stale goods.
They are penny wise and pound foolish.
They think inferior will take the place of good.
They imitate their neighbors.
They fail to clean their windows.
They sit and read newspapers too much.
They are not polite or accommodating.
They think most things take too much trouble.
They fail to use plenty of light.
They do not furnish good materials.
They are not neat or cleanly in person.
They fail to push business.
They are not awake to the seasons.
They know not imitations are but shadows of the real.
They do not study light or shade.
They ought to make goods in a strong light.
They ought to sell them in shaded light.
They know that there is an idea in flavors.
They know not the weakness of humanity's stomach.
They should throw ether flavors to the dogs.
They know not the best is the cheapest.
They put goods up in poor style.
They use poor judgment in colors.
They fail to shine up and clean store up daily.
They fear to buy stock. No stock, no trade.
They know not the power of method.
They fail to pile stock up and let the people see it.
They fail to keep signs and fronts bright.
They fail to give loafers the cold shoulder.
They have hangers on who eat them up.
They are too social where it don't pay.
They fail to shake sponges and dead-beats.
They go out too often to see a man.
They don't treat travelers or drummers politely.
They can get many ideas from them that pay.
They are illiberal to home enterprises.
They do not use cheap fruits to advantage.
They attend to everything but their own business.
They have their head muddled with beer.
They have their tongues thickened with drinks.
They let their breaths reek with alcohol.
They fail to keep system and good order.
They smoke or chew tobacco in business.
They make no changes in spring or autumn.
They fail to meet the wants of the season.
They always stay at home, and travel not.
They become rusty and lose ambition.
They do not progress with their cities.
They try not to better their stores.
They fail to paint and rejuvenate the interior.
They think money thus spent is thrown away.
They know not the power of printer's ink.
They fail to remember their art is a science.
They know not it is allied with the fine arts.
They know not it has been so considered for ages.
They fail to consider their weak points.
They must wake up to the idea of improvement.
They will then find business and prosperity.

Tele-Photography.

Mr. Shelford Bidwell describes in *Nature* the result of some experiments in sending pictures by the telegraph. This he accomplished by using an apparatus resembling Bakewell's well known copying telegraph. In the transmitter the image was focused upon a revolving cylinder, to which a selenium cell is attached. At the other end of the wire a platinum point presses against the surface of sensitive paper prepared by passing it through a strong solution of equal parts of iodide of potassium and water. The arrangement is such that the selenium cell, by intercepting the current, causes a white spot to appear on the receiver corresponding in shape and size to the picture focused on the transmitting cylinder. The experiments are as yet crude, but full of promise.

How Manchester, England, is Lighted.—Cheap Gas and Public Profit.

The *Examiner*, of Manchester, England, gives an interesting account of the management of the public gas works of that city. The gas works in Manchester have always been the property of the inhabitants. Originally they were directed by a body of thirty directors selected from the commission of police. Up to 1835 they had a debt of £80,000. It has been the custom from the first to apply the gas profits to town improvements. In 1831 the sum paid for this purpose was £6,900; in 1835 it had risen to £10,133. The price of gas has steadily been reduced. In 1838 it was 12*s.* per 1,000 cubic feet; in 1844, 6*s.*; up to 1870, 5*s.*; then, by a series of gradual reductions, it has come down to last year's figure of 3*s.*; and a further reduction was promised in December last to 2*s.* 10*d.* per 1,000 cubic feet for gas having an illuminating power of 21·32 candles. The profits turned over to the public in 1879 were equivalent to 9½*d.* per 1,000 feet. There is no committee of the council that does more work than this. They are great manufacturers and traders, and, as in any business, every point in connection with buying and selling has to be watched, so as to obtain a satisfactory result. In the mere purchasing of coal cannel, the penny per ton is equal to a thousand pounds a year, as will be seen when we say that 240,000 tons were carbonized last year. On the other side, a reduction in the price of gas of 1*d.* per 1,000 cubic feet means over £8,000 per annum. The committee have been very busy of late years watching the many valuable improvements in gas making, and notably in all labor-saving appliances. They have lately engaged an engineer of ability, whose business it is to watch over the details of production and all the multifarious appliances at the immense works. The heaviest day's consumption has been over thirteen million cubic feet, and the storage capacity of all the holders is over eleven millions. A most important part is the sale of the by-products, ammoniacal liquor, tar, and coke, which in 1879 produced £80,000. New contracts have been entered into for the sale of these residuals, and the committee hoped to realize a still larger amount under this head, and to be in a position this year to consider a further reduction in the price of gas. The committee are alive to all the uses their materials may be put to, and they make exceptionally good bargains for them on behalf of the citizens. The monetary operations of the committee are necessarily on a scale of great magnitude, the total income being nearly £400,000 per annum. They employ about 600 men in summer and 1,300 in winter. For interest on their debt they need £25,000 a year; for sinking fund, £30,000; they light the streets at a cost of £24,000, pay rates, rents, and taxes amounting to £13,000, and charge themselves with depreciation, £27,000. These items come annually to the enormous sum of £119,000, and yet the committee can hand over a profit of £52,000 to the Improvement Committee, and save the rates to that amount. The total sum paid for this latter purpose in relief for rates is about £1,250,000.

The Color Organ.

This consists of a musical instrument, such as an organ, on which a series of colored glasses are placed, having shutters behind them. The shutters are connected with the key board in such a manner that when a given key is touched a shutter drops and the light shines through the corresponding colored glass, and thus, by touching different keys, different colors are shown, or combinations of colors.

In the thirteen whole notes and semitones embraced in a single octave the colors flashed upon the plates appear and correspond with the notes as follows: C, red; C flat, orange red; D, orange; D flat, orange yellow; E, yellow; F, yellow, green; F flat, green; G, bluish green; G flat, blue; A, violet blue; A flat, violet; B, violet, red, or crimson.

These colors are produced mechanically. In each pipe at the rear of the organ is a small shutter facing the light. This color shutter is connected with its appropriate key by a wire. So when C is sounded the C shutter is opened. The light falling on the red glass belonging to C, the ray is reflected on the ground glass plate facing the spectator; D opens the shutter admitting the light through the orange colored plate, and so on with the rest.

The play of color during the performance of a quick air fascinates the eye, and as the tints rapidly appear, disappear, and blend into each other, the beholder is charmed by the gratification of two senses at once, and feels more than understands the harmony established betwixt melody and color. Mr. Bishop, of this State, is the author of this novel instrument.

Postal Money Orders.

Though but sixteen years old the postal money order system has become a gigantic business. The present head of the Money Order Department, Mr. C. F. McDonald, was its originator. The money handled last year amounted to over $100,000,000, and the work of the department is rapidly increasing. About one-eighth of the business is done in this city. In 1879 the transactions numbered 1,161,378, amounting in money to $43,652,278.87. This was an increase over 1878 of 100,119 transactions and $5,000,000. The next year showed 1,351,095 transactions, amounting to $51,231,749.04. This was a gain over the previous year of 189,720 transactions and $7,579,475 67. The money orders issued during the last fiscal year numbered 7,240,587 for the whole United States. This in money reached the enormous sum of $100,352,818.83. The fees paid to the Post Office Department amounted to $916,452.80.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

OFFICE OF SCOTT & HALL,
Burlington, Kansas, March 10, 1881.

We, the undersigned citizens of Burlington, hereby certify that the H. W. Johns Asbestos Roofing, put on our new stores last summer by S. H. Davis of this place, is perfectly wind and water-tight, as well as fireproof. This was proven on Sunday, the 27th of February last, when the stores adjoining burned, and the flames being blown by a strong wind directly upon the buildings had no effect upon the asbestos, even when the woodwork inside the front cornice caught fire and communicated to the sheathing and rafters, which burnt out from under the roofing, so that the roofing had to be cut away to put out the fire underneath. If it had not been for the asbestos our buildings would probably have burned, as well as most of the business part of the town.
D. E. SCOTT, J. M. ALLISON, W. W. VORNARD.

Patent for sale. G. O. Kelter, Spring City, Pa.

Grain Nickel, Nickel Salts, Nickel Anodes, Composition, Felt Buff Wheels. Greene, Tweed & Co., New York.

An automatic surface blow-off by circulation without loss of water, trapping sediment to be blown out at pleasure. Simple, inexpensive, effective. Hotchkiss' Mechanical Boiler Cleaner, 84 John St., New York.

The Mechanical Laboratory of the Stevens Institute of Technology has nearly ready one large Railroad Oil Testing Machine. R. H. Thurston's patents. Price, $450, without countershaft. Address the Director of the M. L. of the S. I. T., Hoboken, N. J.

The Newell Universal Mill Co., Office 7 Cortlandt St., New York, are manufacturers of the Newell Universal Grinder for crushing ores and grinding foundry facings, phosphates, bone, oyster shells, plaster, dyewoods, and all gummy and sticky substances. Circulars and prices forwarded upon request.

Alden Crushers and Pulverizers manuf'd and sold by the Westinghouse Machine Co., Pittsburg, Pa., U.S.A.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 158.

Ten Double-acting Presses, 8 single-acting Presses, 127 Foot Presses, for sale by The George Place Machinery Agency, 191 Chambers St., N. Y.

For best Duplex Injector, see Jenks' adv., p. 204.

Cotton Belting, Rubber Belting, Leather Belting, Polishing Belts. Greene, Tweed & Co., 118 Chambers St., N.Y.

Akron Rubber Works, Akron, O., Manufacturers of Mechanical Rubber Goods.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Sawmakers Wanted.—Anvil hands on large circulars. Address Emerson, Smith & Co., Beaver Falls, Pa.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

For Sale at a Bargain.—One half or whole interest in a Machine and General Repair Shop. Address Machinist, Box 92, Farmington, Iowa.

Portable Railway Track Cars of all Descriptions for Railroad Grading, Sugar Plantations, Mines, etc. Send for circulars. F. W. Carey & Co., 162 Broadway, N. Y.

Cope & Maxwell M'f'g Co.'s Pump adv., page 188.

For the Cheapest Process of Manufacturing Bricks, see Chambers Bros. & Co.'s adv., page 190.

N. C. Banghman's Climax Wash. Mach. See adv., p. 188.

50 cents each will be paid for the following numbers of London *Engineering*. Jan. 14, 28, and Feb. 18, 1876; Sept. 14, 1877. B. R. Western, No. 8 Broad St., N. Y.

For Machinists' Tools, see Whitcomb's adv., p. 173.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, successor to Bliss & Williams, Brooklyn, N. Y.

L. Martin & Co., manufacturers of Lampblack and Pulp Mortar-black, 236 Walnut St., Philadelphia, Pa.

Send to John D. Leveridge, 3 Cortlandt St., New York, for illustrated catalogue, mailed free, of all kinds of Scroll Saws and Supplies, Electric Lighters, Tyson's Steam Engines, Telephones, Novelties, etc.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Within the last ten years greater improvements have been made in mowing machines than any other agricultural implement. It is universally acknowledged that the Eureka Mower Co., of Towanda, Pa., are making the best mower now in use, and every farmer should write to the manufacturers for catalogue, with prices.

Jenkins' Patent Valves and Packing "The Standard." Jenkins Bros., Proprietors, 11 Dey St., New York.

Presses & Dies. Forncute Mach. Co., Bridgeton, N. J.

Wood Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, Limited, Erie, Pa.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 52 Dey St., N.Y.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Wren's Patent Grate Bar. See adv. page 173.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Houston's Sash Dovetailing Machine. See ad., p. 206.

For Thrashing Machines, Engines, and Horse Powers, see illus. adv. of G. Westinghouse & Co., page 190.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Clark Rubber Wheels adv. See page 173.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Saunders' Pipe Cutting Threading Mach. See p. 173.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Saw Mill Machinery. Stearns Mfg. Co. See p. 141.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 172.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 189.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 188.

The I. B. Davis Patent Feed Pump. See adv., p 205.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

Peck's Patent Drop Press. See adv., page 204.

For the best Diamond Drill Machines, address M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Clark & Heald Machine Co. See adv., p. 206.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Turbine Wheels; Mill Mach'y. O. J. Bollinger, York, Pa.

Brass & Copper in sheets, wire & blanks. See ad. p. 206

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. B. Dudgeon, 24 Columbia St., New York.

Eagle Anvils, 10 cents per pound. Fully warranted.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser M'f'g Co., Waynesboro, Pa.

Machinists' Tools and Special Mach'y. See adv., p 205.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 189.

New Economizer Portable Engine. See illus. adv. p. 205.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 205.

Moulding Machines for Foundry Use. 33 per cent saved in labor. See adv. of Reynolds & Co., page 205.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

The Sweetland Chuck. See illus. adv., p. 204.

Toope's Pat. Felt and Asbestos Non-conducting Removable Covering for Hot or Cold Surfaces; Toope's Pat. Grate Bar. C. Toope & Co., M'f'g Agt., 353 E. 78th St., N.Y.

Use Vacuum Oil Co.'s Cylinder Oil, Rochester, N. Y.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

For Superior Steam Heat. Appar., see adv., page 204.

Vick's Seeds best in world. Floral Guide tells how to grow them. See adv., p. 204.

Burgess' Portable Mechan. Blowpipe. See adv., p. 204.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor, Stiles & Co., Riegelsville, N.J.

Lightning Screw Plates and Labor-saving Tools. p. 204.

The New System of Bee Keeping. Every one who has a farm or garden can now keep bees with pleasure and profit. For particulars address Mrs. Lizzie E. Cotton, West Gorham, Maine.

Pat. Steam Hoisting Mach'y. See illus. adv., p. 140.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) C. M. C. writes: I have occasion to finish nickel plated work in different colors, for bands and lines, and have tried using aniline colors mixed with a lacquer, but it rubs off easily, and I wish to get a receipt for a lacquer or japan (light color preferable) that will mix with colors making a smooth finish that will not scratch off easily; also I would like to learn how brass and oreide are treated to give that finish such as is on lamp trimmings, etc. If it needs to be baked please give the degree of heat and time it should be exposed. A. Color alcoholic spirit copal varnish with any of the soluble coal tar dyes previously dissolved in a little absolute alcohol. Warm the work, apply the colored varnish quickly, and harden at about 300° Fah. (higher if the varnish will bear it), in an oven. The trimmings are largely stamped from rolled sheet metal or turned over a mandrel, thinly lacquered with pale shellac and sandarac, in alcohol (or wood naphtha), and the lacquer hardened in an oven as above.

(2) E. McA. B. asks: What per cent of carbon does ordinary cast iron, Bessemer iron, and wrought iron contain respectively? A. Cast iron, 3·2 to 4·7 per cent; when manganese is present, sometimes as high as 5·9 per cent. Bessemer iron contains about 0·45 per cent of carbon. Wrought iron seldom or never contains less than 0·08 per cent of carbon.

(3) T. T. T. asks: What composition is best to put upon iron to prevent rusting underground? A. The following preparation, used for ocean cables and underground iron work, will give satisfaction: Cotton seed or linseed oils, 1 lb.; coal tar, 1; sulphur, 1. Heat separately, mix thoroughly, and heat to 300° Fah., for about 1 hour, at the end of which it becomes pasty and is ready for use. Heat the metal to which it is to be applied. Under ordinary circumstances it will remain unchanged for an indefinite period.

(4) E. W. S. writes: I see in a late number of your valuable paper that you recommend glycerine and alcohol for oil stone. I object to it, for the following reasons: The alcohol evaporates, leaving the glycerine alone on the tools. Glycerine has a strong attraction for water, and will draw it from the air, causing the tools to become coated with rust. I would suggest pure lard oil as the best thing for oil stone. It will not gum, and it preserves the tools from rust.

(5) V. H. writes: In your paper dated January 22, you explain how writing with a saturated solution of alum water may be copied indefinitely by laying it upon a gelatin pad previously rubbed with a wet sponge and the pad afterwards rolled with a printer's roller, when the writing engraved on the pad acts like a lithograph, taking ink and yielding an impression for each fresh inking. Can this suggestion be applied to type writing. I have tried by soaking a strip of muslin in glycerine and copying ink in equal proportions, in which powdered alum had been dissolved in sufficient quantity to operate as you suggest when applied to paper with a pen, but I cannot succeed with the ribbon on the type writer at all. It would be a very valuable assistant to type writing if it could be copied in the cheap and expeditious way you suggest with respect to writing with a pen. A. Try saturated solution of alum in glycerine (made by aid of heat) without the ink. Or add to a saturated aqueous solution of alum just enough glycerine to make a clean not necessarily visible copy with the type. Let the copy remain on the gelatine some time.

(6) J. M. H. asks: 1. Is paper pulp manufactured from pine wood? Yes. See "Technology of the Paper Trade," SUPPLEMENTS Nos. 109, 110, 116, 117, 118, and 123. 2. Give receipt for making glue used by manufacturers of pocket books and bookbinders. A. Mix together over a water bath equal parts of flour paste and good glue size.

(7) G. B. & Co. ask for the best and most recent method of dissolving bones for fertilizing purposes. A. Grind the dry bones and gradually mix them with about one-fourth their weight of oil of vitriol previously diluted with an equal volume of water and cooled. Boiling in a 5 per cent solution (aqueous) of muriatic acid completely dissolves the earthy phosphates from bones, the remaining portions being useful to the glue manufacturer.

(8) J. H. B. asks how to make papier mache for stereotyping. A. Lay a piece of tissue paper upon a perfectly flat surface and paste a soft piece of printing paper, which must be pressed evenly on to the tissue. Lay the paper on the form, previously oiled, and cover with a damp cloth; beat with a stiff brush the paper in evenly; then paste a piece of blotting paper and repeat the beating in; after which three or more pieces of soft tenacious paper are pasted and used in a similar way; back up with a piece of cartridge paper. The whole must then be dried at a moderate heat under a slight pressure. When thoroughly dry brush well over with plumbago or French chalk. When this is done it is ready for the matrix. 2. Can I take a cast with papier mache from a plaster cast? A. No, not very well.

(9) H. L. C. writes: I see reply to M. M. H., as to how to temper iron springs. I submit the following, as it is cheaper and better for large and small springs. Heat to an even red heat, rather low, to prevent cracking; quench in lukewarm water; place in ladle with tallow to cover; heat until tallow burns with a large flame spreading beyond ladle, then set the ladle aside and allow it to cool. Will stand frost, or work under water.

(10) J. T. D. asks (1) for the best way to remove the marks of a friction match from a valuable piece of ground glass. A. Try a little aqua regia (nitric acid, 1; muriatic acid, warm, 3; mix); rinse with water, and scour with a little soap and water and an ordinary nail brush, if necessary.

(11) C. D. V. writes: In SUPPLEMENT, 267, page 4249, you give recipe for chrome ink. Does the addition of sodium carbonate prevent gelatinization, and if not, what can be added that will prevent it? A. Yes, to a certain extent. Use the finest French extract, and avoid an excess of the chromate.

(12) T. A. H. asks: How is the ink—such as is used for making copies from electric pen stencils—made? A. 1. By thinning printer's ink with castor oil; or, 2, dissolving suitable dyes (aniline-coal tar) in glycerine and molasses.

(13) J. A. B. asks: 1. What is the best and cheapest means of hardening paper, without destroying its pliability? A. Pass the paper quickly through strong oil of vitriol and wash thoroughly in running water; or use a hot syrupy solution (aqueous) of zinc chloride, and rinse quickly and thoroughly in water containing a trace of soda. 2. Where can I obtain the fullest treatise on the chemical (or other) manufacture of paper pulp from wood, etc.? A. See "Technology of the Paper Trade," Nos. 109, 110, 116, 117, 118, and 123. SCIENTIFIC AMERICAN SUPPLEMENT.

(14) C. A. B. asks for a cheap and simple method of frosting windows and glass doors without the use of paint. A. Clean the glass and moisten it with ordinary hydrofluoric acid. As soon as the frosting is satisfactorily completed wash off with water.

(15) P. A. asks for a good receipt for making an oil paste shoe blacking. A. Ivory black, in impalpable powder, 1 oz.; molasses, ½ oz.; sperm oil, ½ oz.; sulphuric acid, ¼ oz.; hydrochloric acid, ¼ oz.; mix the first 3 ingredients, then add the acid with enough water to reduce to proper consistence. Triturate together until a perfectly homogeneous paste is obtained.

(16) A. H. asks: What are the ingredients used by taxidermists to embalm small birds? A. Consult Brown's "Taxidermist's Manual." 2. What will crystallize to represent a snow storm? A. You fail to state the conditions. 3. Where can I obtain supplies for bird stuffing? A. See Hints to Correspondents and Business and Personal column.

(17) E. D. V. says, in answer to J. R. K. and others, who have asked about copying pads: "I have made and used almost every kind of pad proposed, and find that pure gelatin and pure glycerine, without any addition, such as sugar whiting, sulphate of baryta, etc., make the best pad. The consistence and color the latter gives is an evil and not a benefit. With whiting or the sulphate added fewer impressions and more difficulty of erasing are the results. 1 oz. of French pink gelatin and 8 oz. (by weight) of glycerine. Soak the gelatin in cold water one hour; it will be flaccid. Have the glycerine hot in a pail in a water bath, or remove the lid from the tea kettle and set the pail in its place. Wring the water from the gelatin in a towel; then put it into the hot glycerine and stir till well broken up. Heat it several hours. It will give a crimson transparent pad; good glue will give a brown transparent pad; cheap glue a miserable pad. 1 oz. violet aniline 6 B. in one pint hot water, with ½ oz. gum arabic and tartaric acid, gives a good ink." W. H. F. says: I have had occasion to use the gelatin copying pad a good deal, and find that 2 oz. good gelatin in 1 lb (avoirdupois) of glycerine (about 1 to 8) prepared as directed in your article (page 100, vol. xlii.), gives the best result. Whiting and sulphate of baryta are not beneficial.

(18) A. M. asks how to make a cement that will unite leather shavings or leather that has been ground to a pulp, so that when it is rolled out and pressed it will not crack or break when doubled, and be of use in places where strength is not requisite. A. Thin coal tar, cotton seed oil, and sulphur, equal parts; fuse together at a moderate heat. Mix the dry pulp thoroughly with this and expose the mixture for about an hour to a temperature of about 300° Fah. The hot sulphur produces a kind of vulcanization in the mass which renders the composition tough and flexible.

(19) F. H. B. writes: I have some Florida orange blossoms preserved in alcohol, which smell very sweet. How can I extract a perfume from them? A. Essential oil of orange flowers (oil. neroli) is usually obtained by distilling the flowers in a retort along with an equal quantity of water—the oil volatilizes, passes over, condenses with the steam, and is easily separated from the distilled water, which is returned to the retort for a second distillation. About 600 lb. of the flowers produce only one ounce of the essential oil. A weak alcoholic essence may be obtained by macerating the flowers with spirit of wine or by percolation,

(20) S. G. M. asks: 1. Is the induction coil used with carbon telephones because the induced current is able to overcome the resistance easier? A. Yes. 2. If so, why cannot I use a carbon telephone on a very short line, without induction—wire is No. 21? A. You can; but the effect is greatly increased by the induction coil. 3. Is the Lyon's telephone transmitter, described in SUPPLEMENT, 163, of practical value for talking? A. Yes.

(21) J. B. writes: I am engaged in dyeing large quantities of small bone articles. I want to dye them quick and cheap. I use logwood. It only gives me a surface dye. I want it at least one-sixteenth inch deep. Can you give me a good cheap receipt? A. Dip the articles for a few moments into a strong, hot, aqueous solution of caustic potash; rinse in plenty of hot water; boil in a strong aqueous solution of equal parts tannic acid and logwood extract, or logwood and cutch, then in acetate of iron.

(22) B. & H. ask (1) whether the enamel that is used on tin ware to make it look like marble can be used on cast iron. A. Yes. 2. If so, what is it made of, or where can it be had? A. Fine kaolin, 3 parts; silica, ½ part; calcined borax, 1 part. Mix and fuse in a crucible. Remove from the fire and stir in 1 part fine umber. Cool quickly, grind to a fine powder, mix with water to a paste, and apply to the clean metal. Dry slowly in a warm place; then heat gradually in a muffle or seggar until the enamel fuses. Cool slowly.

(23) G. S. asks how to prevent fire clay from cracking while it is drying. A. Mix the clay very thoroughly and with as little water as possible, and dry very slowly in the air before kiln drying.

(24) J. H. asks: Is there any known method of depositing a film of gold on glass? A method similar to that used in depositing silver would be most suitable for my purpose. A. Try the following: 1. Gold chloride, 1 drachm; distilled water, 2 oz.; dissolve. 2. Oxalic acid (pure) 1 oz.; water, 6 oz.; dissolve. Clean the glass thoroughly, warm the plate, and pour over it a mixture of equal volumes of the above solutions to a depth of a quarter of an inch, the edges being rimmed with gutta percha putty as in silvering. Let it stand about six hours.

(25) P. S. M. asks: 1. What is horse power of upright tubular, water leg boiler, 4 feet 6 inches high (including leg), 2 feet 4 inches diameter, 78 1½-inch tubes 2 feet 6 inches long? After passing out of top of tubes the products of combustion dive outside of shell to fire about two-thirds of distance to lower end of tubes. A. About 5 horse power. 2. What size horizontal tubular boiler of usual style would be equal to above in steaming power? A. A boiler having about 70

feet fire surface. 3. Used for house heating how many square feet of radiating surface should above boiler supply to advantage? A. About 600 feet.

(26) B. & A. Co. write: We have two shafts running 1¼ inch to the foot out of line, with two pulleys attached, 36 inches diameter, 10 inch face, run by an upright belt, and the belt in running runs off both pulleys on the same side 1¼ to 2 inches; both pulleys are turned the usual way crowning, and running at a speed of two hundred revolutions a minute. What we wish to know is, if we have one or both pulleys made a little crowning off the center, will it lead the belt on straight, and would we get full power of belt; and if we should make them doubly as crowning would it make any difference? A. Crowning will do no good. Your only mode of correcting the evil is to so place carrier pulleys or oilers, that the belt shall run on both pulleys at right angles to their respective shafts.

(27) C. S. writes: I bought SUPPLEMENT, 142, in view of constructing me a telephone for a private line. But there are several points I would inquire further about. 1. Should the ends of the coil wire wound around the spool touch the connection wire fastened in the binding post? A. Yes. 2. How can I tell the like poles on magnets? A. Present the poles to a compass needle. Poles that produce the same effect are alike. 3. Would common tin do for the diaphragm, or what other material should I use? A. Tin is too thick. Use ferrotype plates. 4. Should I use No. 36 common copper wire for connecting the instrument with another? A. Use No. 12 iron wire for your line.

(28) A. S. R. asks (1) for information on melting and pouring caoutchouc. A. Caoutchouc cannot be melted and poured as you suggest. When heated to the fusing point it suffers partial decomposition. 2. Is there a work published on the manufacture of Indian arrow heads? A. We know of no book on this subject.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

T. H. B.—1. Marmolite. 2. Hornblende in quartz. 3. Dolerite. 4. Feldspar and hornblende. 5. Chiefly quartz. 6. Hornblende. 7. Sandstone and lime carbonate.—S. W.—1. Heavyspar—barium sulphate. 2. Limonite on quartz. 3. Gypsum. 4. Ferruginous lime sulphate (deposit). 5. Pyroxene. 6. Chrysocolla. 7. Graphite in sandstone. 8. Chiefly quartz and limonite. 9. Limonite on quartz.—N. O. G.—It is tourmaline (hardness 7·5—corundum is 9, diamond 10).—E. G.—The powder contains traces of gold—hardly rich enough to pay.—J. M. S.—The small pebble (one) is quartz—not diamond.—T. C. Y.—Your ink, where not used in excess is easily removed.—T. F. W.—Iron, copper, and molybdenum sulphides. It may carry gold, but it will require a fire assay to determine this.—L. H. G.—The rock contains much titaniferous iron ore. Some of it may carry gold. An assay would be advisable.

COMMUNICATIONS RECEIVED.

On a Brilliant Meteor. By C. E. S.

On the Operation of Arsenic and How to Detect Carbonic Oxide. By H. M. D.

NEW BOOKS AND PUBLICATIONS.

ZEITSCHRIFT FUR INSTRUMENTENKUNE (JOURNAL OF SCIENTIFIC INSTRUMENTS). Edited by Dr. G. Schwirkus. Berlin: 1881. Julius Springer.

This monthly publication, the first number of which is now before us, is devoted to scientific instruments and the experiments therewith. Each number will contain illustrations and descriptions of the modern scientific instruments, the opinions of scientific men in regard to the same, and all possible improvements and observations in manufacturing the instruments will be given, so as to enable one manufacturer to profit by the experience of others, whereby the accuracy of scientific instruments in general will be greatly improved. All patents for scientific instruments will also receive proper notice. The leading savants of Germany, such as Messrs. C. Bruhns, of Leipsic; Bauernfeud, of Munich; v. Lang, of Vienna, and many others contribute to this work. The first number contains articles by Fuess, on Normal Barometer; Illuminating Micrometer Devices, by Foerster; Micrometer Screws, by Reichel; Vogel and Lohse, on Spectral Apparatus; Kronecker, on Graphical Methods in Physiology, etc. This work is printed in clear English type.

PROYECTO DE ORGANIZATION DE LA SECCION DE ESTUDIOS DEL ATENEO DEL URUGUAY. Por el Doctor F. A. Berra. Montevideo: 1880.

This volume of over 250 octavo pages is an elaborate plan for a total reorganization of the course of studies now pursued at the Atheneum of Uruguay. It seems that these studies have hitherto been quite elementary—just enough to give the student sufficient education to qualify him for business, but not enough to fit him to become a prominent member of society or even to qualify him for the duties of a public life. The consequence is that the administration of the government falls into the hands of a few privileged persons. This state of things for a republic is justly considered radically wrong by the promoters of the project under consideration. Hence the elaboration of a plan to give all the youths of the nation a liberal education which shall make them ornaments of society and good citizens, who shall be capable, when their country calls upon them, of filling any public office to which they shall be elected. The proposed course of instruction here laid down seems to be quite elaborate, and equal to that found in the curriculum of any prominent college or university. Dr. Berra and his associates are to be wished all success in their noble and patriotic undertaking.

THE MAGAZINE OF ART. Cassell, Petter, Galpin & Co. New York.

The March number of this entertaining art publication has made its appearance, and, like the preceding numbers, it is full of illustrations, and complete in interest to all lovers of art in varied departments.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 1, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Air compressor, H. F. Fitzpatrick 238,374
Air compressor, hydraulic, W. R. Freeman 238,235
Atomizing tube, flexible, I. Heine 238,368
Awning fitting, T. Williams 238,265
Axle box, car, E. R. Esmond 238,280
Axle box, car, G. J. Maxwell 238,242
Axle, wagon, S. G. Mason 238,290
Bale ties, machine for splicing or connecting, L. Miller 238,417
Barrel for holding cranberries, etc., J. Collins 238,215
Barrel head, F. G. Johnson 238,397
Bed bottom, sprine, Creager & Burdick 238,216
Bed bottom, spring, R. Stilwell 238,476
Bedstead attachment, G. G. Gibson 238,282
Bell, door, J. W. Johnson 238,208
Belt clamp, waist, J. E. Parsons 238,247
Belt connection, M. Schulze 238,443
Belting, G. A. Ambler 238,200
Bicycle luggage carrier, F. Morris 238,245
Billiard table, S. May 238,414
Binder's reel, Konold & Deming 238,403
Blind slat adjuster, Pierson & Hill 238,309
Boiler furnace, steam, A. L. Holley 238,225
Boot and shoe, J. A. Safford 238,312
Boot and shoe heel burnishing tool, Z. Beaudry 238,206
Boot and shoe heel plate, S. Crowley 238,262
Boot and shoe heels, machine for shaving and breasting, B. J. Tayman 238,456
Boot and shoe sole edges, rotary cutter for trimming, W. D. Orcutt 238,300
Boot and shoe stretcher, Couch & Glines 238,257
Boot and shoe soles, metallic plate for, W. A. Ingalls 238,394
Boots and shoes, removable sole for, W. Sachs 238,441
Bottle washer, J. M. Hoyt 238,289
Bottle washer, C. Pease 238,306
Brush, G. A. Scott 238,444
Buckle, ornamental bridle, T. Noble 238,436
Buffing pad, A. Andrés 238,201
Buggy body, S. A. Nolen 238,246
Buggy top attachment, E. N. Heney 238,286
Button, detachable, W. P. Dolloff 238,268
Button or stud, Burdon & Brown 238,342
Cabinet, J. Sorenson 238,452
Can, T. G. F. Dolby 238,219
Can heading machine, W. J. Clark 238,351
Can opener, J. J. Henry 238,288
Cans, closing metal, J. Broughton 238,208
Car brake, G. Brenner 238,211
Car brake, H. Gallager 238,279
Car coupling, Arter & Blocher 238,333
Car coupling, E. Delira, Jr. 238,264
Car coupling, S. Nichols 238,422
Car coupling, T. Noble 238,435
Car coupling, M. C. Quimby 238,493
Car door fastening, J. B. Calkins 238,344
Car, railway, C. M. Kimball 238,230
Car, sleeping, J. H. Doerr 238,267
Car, sleeping, F. W. Hunter 238,226
Car, sleeping, T. T. Woodruff 238,470
Car, stock, W. F. Mitchell 238,243
Car, stock, T. Noble 238,424
Car, stock, A. F. S. Osterburg 238,304
Car, strawberry, A. H. Fogg 238,223
Car wheel, R. N. Allen 238,475
Car wheel and axle, O. T. Southworth 238,257
Cars, life guard or wheel guard for street, J. Stephenson 238,258
Carburetor, J. T. Guthrie 238,386
Carpet sweeper, C. O. Allen 238,331
Cartridge shells, machine for drawing, A. C. Hobbs (r) 9,504
Carving fork, C. L. Butler 238,276
Caster, W. C. Coddington 238,255
Cerate, S. E. Hyndman 238,227
Chain, ornamental, E. A. Jenks 238,396
Chain swivel, watch, J. Homer 238,391
Cheese vat, T. B. Wire 238,319
Churn, E. S. Gibbs 238,229
Clevis, plow, I. R. Gilbert 238,284
Clipper, hair, G. H. Coates 238,353
Clock, electric, A. Personne 238,438
Clock pendulum, E. Horton 238,392
Clothes prop, G. O. Lackey 238,404
Coffin handle, C. A. Bailey 238,328
Coffins of clay, etc., manufacture of, W. H. Bachtel 238,268
Cooker, steam, T. J. Whitney 238,264
Corn husks, etc., machine for disintegrating, W. A. Wright 238,472
Corrugating machine, W. Wilson, Jr. 238,468
Cotton and hay press, Cory & Holland 238,356
Crane, steam, W. H. Ridgway 238,438
Cruppers, process of and machinery for making, J. Shaffer 238,446
Culinary pot, W. N. Barrows 238,272
Currycomb, W. E. Lawrence 238,297
Curtain cord tightener, T. Arndt 238,202
Cylindrical bodies, device for swaging, C. B. Morse 238,421
Damper, C. E. Sutphen 238,259
Damper regulator for furnaces, D. C. Kellem (r) 9,500
Digging and grading machine, J. M. Caraway 238,346
Door hanging, sliding, E. Prescott 238,310
Doubletree attachment, C. F. W. Goernandt 238,229
Draught equalizer, L. O. Brokke 238,337
Drilling machine, T. R. Morgan 238,244
Dyers' and bleachers' shells, tool for coring, R. Bell 238,207
Dumb waiters, fan attachment for, J. W. Pettengill 238,439
Earring, G. W. Washburn 238,318
Earthenware vessel handle, H. Mishler 238,420
Egg beater and mixer for kitchen use, H. Howson, Jr. 238,393
Electric machines, current regulator for dynamo, Thomson & Houston 238,315
Eyeglass supporter, F. A. Hardy 238,285
Fan, sun shade, J. H. Dennis 238,265
Faucet, H. Mattullath 238,300
Faucet attachment, J. P. Gruber 238,223
Feed trough and hay rack, J. M. Holladay 238,390
Felt hardening machine, Yule & Yocom 238,467
Fence, W. Churchman 238,348
Fence barb, wire, M. C. Shinn 238,447
Fence, barbed wire, T. Shuman 238,255
Fence post, P. Coughlin 238,258
Fencing, barbed metallic, G. W. Kirchhöffer 238,296
Fertilizer, J. M. & J. Lippincott 238,240
Field roller, Blackford & Reno 238,206
Fifth wheel, vehicle, Campbell & Nelder 238,345
Filter for water service mains, J. H. Barnes 238,330
Fire escape ladder, S. Torrance 238,460
Flax brake, W. A. Wright 238,266
Flue for furnace registers, supplemental, C. H. Fifield 238,222
Gas burner, J. F. Barker 238,205
Gas governor, W. Cowan 238,259
Gas lighter, electrical, C. D. P. Gibson 238,283
Gas lighting and extinguishing device, automatic, J. M. Foster 238,277
Gas, manufacture of illuminating, A. W. Wilkinson (r) 9,505
Gas regulating burner, H. W. Rappleye 238,435
Gas regulator, J. M. Foster 238,275
Gas works, door frame for retort benches of, A. H. Lowell 238,411
Glove, H. Urwick 238,262
Governor, marine engine, W. Würdemann 238,473
Grain binder, J. Augspurger 238,327
Grain binder, A. Goodyear 238,230
Grain binder, F. Ogden 238,302
Grain binder, J. D. Reed 238,436
Grain binder, automatic, S. V. Essick 238,371
Grain binder tension, W. R. Coats 238,254
Grappling bucket, F. G. Johnson 238,293
Grate, fire, C. W. Doton 238,219
Grinding machine, W. H. Doane 238,366
Grinding mill, J. S. Tarr 238,260
Hame attachment, W. O. Miller 238,418
Harrow, C. Tolle 238,458
Heating buildings, apparatus for, E. A. Wood 238,469
Hinge, E. G. Adams 238,330
Hoop cutting machine, F. L. Wilson 238,467
Hop picking machine, H. G. Locke 238,409
Hose coupling, D. B. Kendall 238,294
Hose sprinkler, J. W. Killam 238,295
Hydrant, H. Robinson 238,311
Invoice or scrap book, T. Hartung 238,283
King bolt, T. Graser 238,383
Kitchen boiler, G. Salmon 238,442
Lacing hooks, machine for setting, M. Bray 238,335
Lacing studs or hooks, machine for setting, M. Bray 238,336
Lamp, F. G. Palmer (r) 9,502
Lamp, W. H. Smith 238,450
Lamp extinguisher, W. H. Kittle 238,402
Lamp, lime light, A. M. Khotinsky 238,400
Lamp, safety, M. A. Heath 238,284
Lathes, mechanism for operating the slide rests of, W. Sellers 238,254
Leather, artificial, C. A. Evans 238,372
Leather, manufacture of, C. Heinzerling 238,289
Lifting jack, A. Garrison 238,280
Lock strike, H. Fellows 238,273
Locomotive, C. B. Clark 238,349
Locomotive saddle and stack, A. Berney 238,273
Lumber sorter, E. T. Davies 238,220
Magnet and magnetic telephone, S. Russell 238,253
Magneto-electric signaling apparatus, J. S. Brown 238,212
Malt in brewing, etc., treatment of starch and starchy substances, and the production therefrom of a compound used as a substitute for, Sullivan & Valentin 238,474
Meat safe and smoker, F. M. Woods 238,471
Middlings purifier, A. H. Kirk 238,401
Milk and preserve jar, F. Henry 238,287
Milk, preparation of sour, C. Peck 238,248
Millstone, J. Y. Trammell 238,461
Millstone dress, B. C. Lambeth 238,405
Millstone spindles, apparatus for driving, S. Potts 238,432
Mosquito bar, revolving, E. Solomons 238,313
Mower, lawn, Mast & Martin 238,412
Musical box, D. Aubert 238,336
Musical instrument, mechanical, M. J. Matthews 238,413
Nursery chair, E. S. French 238,226
Nut lock, J. W. Bunker 238,340
Ore drying furnace, C. Stetfeldt 238,455
Oxidation furnace, G. W. Baker 238,270
Oyster car, E. H. Frazier 238,378
Painting on velvet in oil colors, L. Farquharson 238,221
Pantaloons, reversible, L. M. Brock 238,273
Pants stretcher, C. C. Chase 238,347
Paper and manufacturing the same, M. Newton 238,422
Paper, making wood pulp for, H. H. Furbish 238,227
Paper pulp, machine for making frames or castings for lamps from, Stevens & Chisholm (r) 9,503
Paper tube machine, A. Tillmos 238,457
Perfumes of natural flowers by absorption, obtaining, R. A. Chesebrough 238,277
Piano action, M. J. Chase 238,214
Piano coupling, J. M. Foster 238,276
Pipe coupling, G. H. Reynolds *et al* 238,437
Plaiting machine, C. Clark 238,260
Planters, coupling stop and wire for check row, J. C. Dupee 238,370
Pole tip, I. R. Gilbert 238,285
Press, T. A. Watrous 238,463
Printing machine, chromatic, T. B. Dooley 238,278
Pump and sprinkler, A. J. Polansky 238,430
Pump, portable force, S. Bonser 238,333
Rake, W. S. Pickett 238,249
Refrigerating apparatus, air, T. B. Lightfoot 238,408
Refrigerating cover, portable, A. C. Pecor 238,307
Refrigerator, P. Bals 238,204
Road or tramway for vehicles, T. S. Mills 238,419
Rolling iron, method of and apparatus for, M. V. Smith 238,449
Rub rolls, hanging and driving device for, J. Barker 238,329
Sand paper roll, H. L. Hapgood 238,284
Sash cord fastener, W. H. Day 238,263
Sash fastener, W. Tyler 238,462
Saw gummer, gin, J. B. Clopton 238,253
Scarf, neck, W. A. Laverty 238,406
Scoop, wooden, E. P. Phillips 238,308
Sewing, book, D. M. Smyth 238,451
Sewing machine spinning attachm't, J. C. Blackett 238,332
Shaft coupling, J. State 238,454
Shawl strap, M. Rubin 238,440
Silo, L. H. Whitney 238,466
Smoke and gas consuming furnace, W. D. Smith 238,256
Snap hook, A. N. Bragg 238,259
Soap, A. C. Selby 238,445
Soldering apparatus, N. Jenkins 238,291
Soldering machine, automatic, J. A. Forbes 238,224
Spectacle frame, J. L. Borsch 238,274
Spokes and felloes, machine for tenoning and boring, M. P. Ellison 238,279
Stamp, canceling, D. C. Breed 238,210
Staples for fences, machine for forming, W. D. Brown 238,339
Steam engine, compound, M. MacMahon 238,241
Steering apparatus, steam, G. W. Baird 238,269
Stove, L. F. Betts 238,331
Stove burner, gas, A. W. Morton 238,301
Stove lamp, J. H. Irwin 238,295
Stove leg, J. McMaster 238,415
Suspenders, W. G. Anderson 238,325
Telegraph, duplex, G. Smith 238,448
Telegraph, dynamo-electric, O. Lugo 238,298
Telegraph mechanism, S. M. Plush 238,250
Telephone, electric, S. Russell 238,254
Telephone exchanges, pole changer for, E. P. Warner 238,263
Telephone relay, C. T. Tomkins 238,459
Telephone signaling apparatus, G. W. Coy 238,260
Telephone switch board, T. De Lockwood 238,217
Telephone systems, circuit changer for district, G. W. Coy 238,261
Telephone systems, shunt for speaking, F. W. Jones 238,299
Telephonic transmitter, C. A. Randall 238,434
Testicle support for stallions, S. Taylor 238,261
Thill coupling, A. Walter 238,316
Tool holder, J. F. Allen 238,322
Tooth crown, artificial, W. G. A. Bonwill 238,334
Tooth crown, artificial, W. H. Gates 238,282
Torch, J. A. McPherson (r) 9,501
Toy cymbal, J. White 238,465
Trimming, M. Lowenstein 238,410
Truck, locomotive, J. Apsey 238,324
Trunk clamp, J. J. Feth 238,281
Tube skelps, device for handling, W. C. Allison 238,199
Type writer, T. Hall 238,387
Umbrella, P. A. Meurgey 238,416
Umbrella, parasol, etc., C. C. Juif 238,298
Vehicle seat fastener, G. Ward 238,317
Vehicle spring, S. Palmatier 238,427
Vent for beer kegs, automatic air, J. B. Gruber 238,231
Ventilating and cooling buildings, E. E. Rice 238,251
Voting machine, A. M. Stephens 238,314
Washing clothes, device for, J. B. Calkins 238,213
Washing machine, S. Parks 238,305
Watch, chronograph, J. S. Aubert 238,203
Watch, stem winding, P. H. Wheeler 238,464
Water closet valves, mechanism for operating, J. H. Spencer 238,453
Water supply for cities, C. H. Roberts 238,439
Window, bay, W. S. Garrison 238,381
Wood preserving compound, W. W. Bunnell 238,341
Wood, stone, etc., machine for dressing, N. Jenkins 238,290
Wood, stone, etc., machinery for dressing or shaping, N. Jenkins 238,292
Wrench, B. Donohue 238,269
Wrench, combination, Butler & Campbell 238,343
Wringing machine, R. G. Baldwin 238,511

DESIGNS.

Carpet border, Chambellan & Magee 12,181
Jewelry, J. F. Chatellier 12,180

TRADE MARKS.

Blacking, shoe, C. Leroy 8,183
Cigars, cigarettes, and chewing and smoking tobacco, D. E. Rose 8,184
Cigars, cigarettes, and smoking and chewing tobacco, S. Hernsheim & Brother 8,185, 8,186
Corsets, ladies', L. Schiele & Co 8,180
Explosive compound, Thunder Powder Company 8,187
Flour, wheaten, Lyon, Dupuy & Co ..... 8,177 to 8,180
Paper of all kinds, writing, Hard & Parsons 8,178
Spices (ground), flavoring extracts, salad dressing, and sauces, E. R. Durkee & Co 8,188
Tobacco, cigars, cigarettes, and snuff, smoking and chewing, C. W. Allen 8,176
Tobacco, fine-cut, smoking, and plug chewing, C. W. Allen 8,175
Watch, L. Strasburger & Co 8,185, 8,186

English Patents Issued to Americans.

From February 25 to March 1, 1881, inclusive.

Compass, needles for, J. Lewis *et al.*, Mass.
Compound for treating iron, A. H. Siegfried *et al.*, Selins Grove, Pa.
Electric lamp, T. A. Edison, Menlo Park, N. J.
Electric lamp, T. A. Edison, Menlo Park, N. J.
Hydrocarbon furnace, B. Sloper *et al.*, Washington, D. C.
Illuminating, E. B. Reynolds, Cleveland, Ohio.
Packing box machinery, F. Myers, N. Y.
Paper drying machinery, L. A. Turner, Chicago, Ill.
Paper punching machinery, Automatic Music Paper Company, Boston, Mass.
Paving cement, E. J. de Smedt *et al.*, Washington, D. C.
Printing press, E. B. Welch, Cambridge, Mass.
Printing press, W. H. Golding, Chelsea, Mass.
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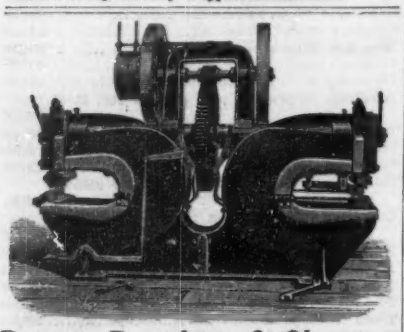

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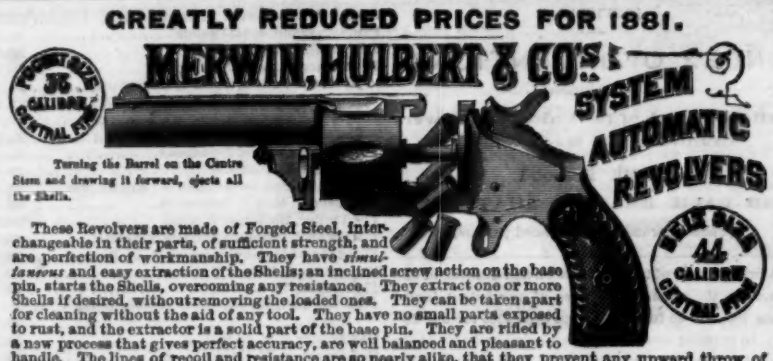

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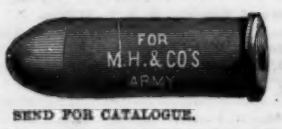

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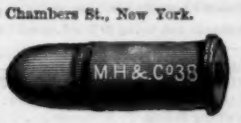

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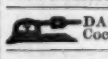

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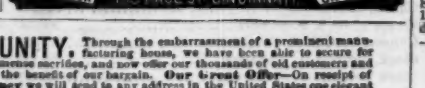

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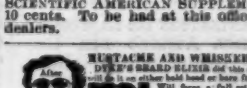

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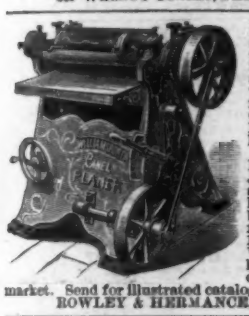

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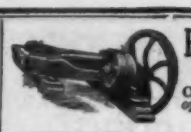

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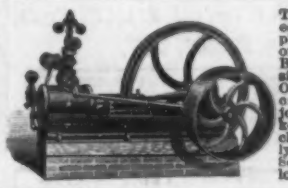

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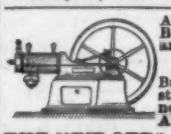

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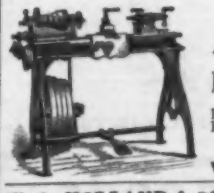

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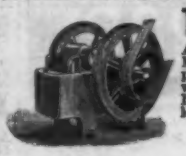

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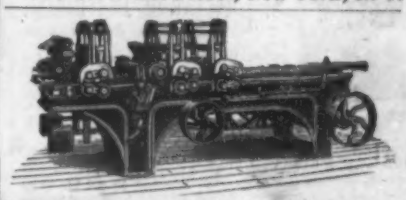

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